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ORIGINAL RESEARCH

A Qualitative Study of Migraine Headache Experience in Patients with Patent Foramen Ovale Based on the Symptom Management Theory

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Objective: To explore the migraine experience of patients with patent foramen ovale (PFO) and migraine based on the Symptom Management Theory(SMT).

Methods: A qualitative research approach was employed to conduct face-to-face, semi-structured, in-depth interviews with 16 patients diagnosed with PFO and migraine at the Department of Cardiology, The Third People's Hospital of Henan Province, from March to June 2025. The collected data were analyzed using the Colaizzi phenomenological method.

Results: The migraine experience of patients with PFO was categorized into 3 main themes: 1) Symptom Perception: Variability in migraine severity and frequency (mean VAS 5.2 ± 1.8, indicating moderate symptom severity); Triggers and warning signs of migraine attacks; Impact of environmental and lifestyle factors on symptom onset. 2) Symptom Management: Persistent efforts to alleviate migraine symptoms (eg, medication, lifestyle adjustments); Emotional and psychological coping strategies; High expectations and hopes for the PFO closure procedure; Concerns and uncertainties about the effectiveness of the operation. 3) Symptom Outcomes: Physical and mental health challenges caused by chronic migraines; Social and occupational disruptions due to migraine symptoms; Seeking professional medical and psychological support; Long-term adaptation and resilience strategies.

Conclusion: This study, grounded in the SMT, provides valuable insights into the migraine experiences of patients with PFO. The findings highlight the multifaceted nature of their symptom perception, management, and outcomes, emphasizing the profound physical, emotional, and social impact of chronic migraines on their lives. Patients' persistent efforts to manage symptoms, coupled with their high expectations for the PFO closure procedure, underscore the need for comprehensive, patient-centered care.The study also reveals the critical role of professional support in addressing both the physical and psychological dimensions of migraine management. Healthcare providers should prioritize personalized, multidisciplinary approaches to care, focusing on symptom relief, emotional well-being, and long-term adaptation strategies. Future research should expand the scope to include diverse geographical populations and explore long-term postoperative experiences to further enhance understanding and improve clinical interventions for this patient group.

Keywords: PFO, migraine, SMT, qualitative research, patient experience, pain management, quality of life

Introduction

PFO is one of the most common structural congenital heart defect of the adult heart, with a prevalence of 14.7% to 31.3% in the general population.[1] These patients is highly susceptible to migraine symptoms, with the probability of migraine with aura ranging from 46.3% to 88.0%.[2] The pathogenesis of PFO-related migraine is unclear, and the most recognized hypotheses are the paradoxical embolism hypothesis and the vasoactive substance hypothesis.[3] The former hypothesis suggests that microemboli in the veins can enter the cerebral arteries directly through the PFO, leading to hypoperfusion

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or cortical spreading depression of the cerebral arterial supply area, triggering neurogenic inflammation and migraine.[4] In the latter hypothesis, it is believed that due to the presence of the PFO, vasoactive substances such as 5-hydroxytryptamine and calcitonin gene-related peptide in the veins can cross the pulmonary circulation into the arteries without being inactivated by the enzymes in the pulmonary capillaries, and then directly pass through the trigeminal nervous system of the blood-brain barrier and cause migraine.[5,6]

Migraine is a disease with a high incidence rate in the general population, with a prevalence of approximately 12%.[7] Studies have shown that migraine, especially migraine with aura, is associated with PFO. Migraine may also be accompanied by symptoms such as nausea and vomiting, causing severe discomfort to the patient.In patients with migraine with aura, the incidence of PFO ranges from 46.3% to 88%, while in patients with migraine without aura, the incidence of PFO is between 16.2% and 34.9%, which is comparable to the incidence of PFO in the general population.[7] Migraine has become a major indication for percutaneous PFO closure.[8] When a large volume of venous blood passes through the PFO into the systemic circulation, it may trigger a significant release of serotonin. This surge in serotonin may activate one or several hyper-responsive receptors in the cerebral blood vessels, thereby inducing cortical spreading depression,[9] which subsequently leads to reactive vasodilation and causes headaches. In recent years, multiple studies have confirmed that the prevalence of PFO in migraine patients and the incidence of migraine in PFO patients have both shown an upward trend.[10]

The relationship between PFO and migraine, as well as the impact of percutaneous PFO closure on migraine, has been a focus of debate for over 20 years.[11] Some scholars have pointed out that migraine symptoms significantly improve after PFO closure, with more pronounced effects observed in patients with migraine aura.[12] However, other studies have shown no significant differences in the prevalence of PFO between migraine and non-migraine patients, or between patients with and without migraine aura.[13,14] There is considerable heterogeneity among these studies, and the conclusions are not entirely consistent, with the correlation between the two conditions requiring further validation.

In recent years, occlusion has been gradually used to treat patients with pre-closed foramen ovale and migraine.[15] Studies have found that interventional closure has similar efficacy in headache relief in patients with moderate or large amounts of foramen ovale and migraine.[16] However, the closure surgery still cannot completely relieve migraine, and migraine still plagues patients for a long time.[17] Some researchers conducted qualitative research on patients with sudden migraines and found that migraine attacks are much more complicated than just experiencing pain.[18] After a group of people with different characteristics or causes of disease develop migraine, patients and their families will suffer from long-term disease burden and psychological distress, and have great expectations for disease treatment. The disease experience of different groups has their own characteristics.[18,19] At present, relevant studies on patients with foramen ovale papillary enclosure and migraine are mostly focused on the exploration of pathophysiological mechanisms and clinical efficacy, and there is still a lack of research on the disease experience of patients with PFO and migraine.Patients with PFO have unique perceptions and experiences. It is crucial that we need to fully consider the patient's feelings when developing relevant pain management plans.The Symptom Management Theory (SMT) offers a comprehensive framework for exploring these dimensions. SMT emphasizes three core concepts: symptom experience, symptom management strategies, and symptom outcomes.[20] This theory recognizes the interplay between situational variables, individual perceptions, and symptom outcomes, providing a structured approach to understanding and managing symptoms.[21]

This study is grounded in the SMT, aiming to explore the migraine experiences of patients with PFO, both before and after closure. By delving into their symptom perceptions, response strategies, and pain management needs, this research seeks to provide a robust scientific foundation for developing personalized and effective intervention measures.

Materials and Methods

Participants

We employed Symptom Management Theory (SMT) as the theoretical framework to guide participant selection and data interpretation.The purposive sampling method was used to select inpatients with PFO-related migraine who underwent occlusion in the Department of Cardiology, the third people's hospital of Henan province, Selection criteria explicitly incorporated SMT dimensions (symptom experience, management strategies, and outcomes) by considering age, gender,

duration of migraine and time of the diagnosis of PFO. Self-reported symptom severity (rated on a 10-point visual analogue scale) to maximize sample differentiation. The sample size was used until saturation of information and no new themes were presented.

Inclusion: 1) diagnosis of migraine according to the International Classification of Headache guidelines; 2) diagnosis of PFO by transcranial Doppler ultrasound bubble test combined with transesophageal echocardiography; 3) treatment with percutaneous PFO occlusion; 4) demonstrated willingness to actively engage in the study and adhere to its requirements.

Exclusions: 1) inability to cooperate with the interview process due to cognitive impairments, hearing difficulties, or speech disorders; 2) any instance of withdrawing from the study before its completion.

Study Design and Data Collection

This qualitative study, grounded in the SMT framework, systematically examined migraine experiences in patients with PFO through three key theoretical dimensions: (1) symptom experience, focusing on patients' subjective perceptions and interpretations of migraine symptoms; (2) management strategies, investigating both medical and self-care approaches employed to cope with migraine attacks; and (3) symptom outcomes, evaluating the perceived effectiveness of PFO closure and other interventions in altering migraine patterns and severity. This structured theoretical approach enabled a comprehensive understanding of patients' lived experiences while maintaining methodological rigor in data collection and analysis.

Data collection was conducted through face-to-face, in-depth interviews held in a private area of the cardiology ward at The Third People's Hospital of Henan Province between March and June 2025. Prior to each interview, the study's purpose, procedures, and ethical considerations were explained to participants, with assurances of confidentiality and anonymity. Written informed consent was obtained, and interviews were audio-recorded and supplemented with detailed note-taking to capture non-verbal cues and contextual information.

The interview guide (Supplementary Material 1) was developed based on the study's objectives and a review of relevant literature.To ensure clarity and appropriateness, the guide was pilot-tested with two eligible patients, after which it was refined to form the final interview outline.

Data Analysis

The transcription of interview data is diligently completed within a 24-hour window following each session. This process involves meticulously reviewing the audio recordings, transcribing them word for word into a written format, and enriching the transcripts with annotations. These annotations serve to enhance the accuracy and clarity of the documented information.The interview data was imported into NVivo.[22] We followed the Consolidated Criteria for Reporting Qualitative Research (COREQ) to ensure reporting quality of our focus group interviews.[23] The detailed steps of the analysis are listed in Box 1.

This study was conducted following according to the guidelines developed by the Consolidates Criteria for Reporting Qualitative Research and the Standards for Reporting Qualitative Research.[24,25] The execution techniques and applications for controlling confidence are presented in Table 1.

Results

Demographic Characteristics of Participants

The study included 16 patients with a median age of 40.3 ± 10.2 years (range: 29–60). The sample comprised 7 males (43.8%) and 9 females (56.2%). In terms of education level, 6 participants (37.5%) had completed high school or less, while 10 (62.5%) held a college degree. The majority of participants were married (81.3%), with 3 (18.7%) being unmarried. Regarding economic status, 4 participants (25.0%) reported a good economic level, 11 (68.8%) described their economic status as neutral, and 1 (6.2%) reported a poor economic level. The duration of migraine history among participants varied significantly, ranging from as brief as 3 months to as long as 25 years, with the majority reporting a history of migraines exceeding five years. The time since the diagnosis of PFO was relatively recent, spanning from 1

Box 1 Colaizzi Qualitative Analysis Steps

Colaizzi Qualitative Analysis Steps
1. Familiarization with the Data: Researchers thoroughly read and re-read all interview transcripts to gain an in-depth understanding of the participants' experiences. 2. Extraction of Significant Statements: Phrases or sentences directly related to patients' migraine experiences and their coping strategies before and after PFO closure were identified and extracted. 3. Coding and Categorization: The extracted statements were coded, generalized, and organized into meaningful units. 4. Formulation of Meaning Units: Each significant statement was grouped into a meaning unit, which was then refined into broader topics to capture the essence of the participants' experiences. 5. Detailed Description of Phenomena: The research phenomena were described in detail, providing a comprehensive account of the participants' migraine experiences and coping mechanisms. 6. Theme Identification: Similar ideas were identified and integrated to form overarching theme concepts, reflecting the core aspects of the participants' experiences. 7. Summarization and Validation: Blanket statements were defined to summarize participants' migraine behaviors and the practical effects of PFO closure. These findings were validated by returning to the original transcripts to ensure accuracy and consistency.

Table 1 Executive Techniques and Applications Standard

Standard	**Executive Techniques and Applications**
Reliability	Investigator triangulation: each data source was analyzed. Thereafter, team meetings were conducted during which the analyses were compared and themes were identified. Triangulation of data collection methods: including unstructured interviews, semi-structured interviews, and researcher field notes. Participant validation; this consisted of asking the participants to confirm the data obtained at the stages of data collection.
Transferability	In-depth descriptions of the study performed, providing details of the characteristics of researchers, participants, contexts, sampling strategies, and the data collection and analysis procedures
Validity	Audit by an external researcher; an external researcher assessed the study research protocol, focusing on aspects concerning the methods applied and the study design.
Confirmation	Investigator triangulation, data collection triangulation. Researcher reflexivity was encouraged via the previous positioning, performance of reflexive reports and by describing the rationale behind the study

week to 1 year.Patients presented with clinically significant migraine severity (mean VAS 5.2 ± 1.8, indicating moderate symptoms).Detailed demographic information is presented in Table 2.

Themes and Subtopics

Three core themes were identified from the analysis.Themes and Subtopics are shown in Table 3.

Table 2 Demographic Information of the Patients (n=16)

Variable	**N (%)**
Age in years, median (range)	40.3 ± 10.2 (29—60)
Gender	
Male	7(43.8)
Female	9 (56.2)
Education Level	
< =High school	6 (37.5)

(*Continued*)

Table 2 (Continued).

Variable	N (%)
College degree	10 (62.5)
Marital Status	
Married	13(81.3)
Unmarried	3(18.7)
Economic Level	
Good	4(25.0)
Neutral	11(68.8)
Poor	1(6.2)
Migraine History (Duration)	5 years (3 months–25 years)
Time Since PFO Diagnosis	6 months (1 week–1 year)
Migraine Severity (VAS)	5.2 ± 1.8 (4–8)

Table 3 Themes and Subtopics

Themes	Subtopics
1. Symptom Perception	1.1 Variability in migraine severity and frequency
	1.2 Triggers and warning signs of migraine attacks
	1.3 Impact of environmental and lifestyle factors on symptom onset
2. Symptom Management	2.1 Persistent efforts to alleviate migraine symptoms (eg, medication, lifestyle adjustments)
	2.2 Emotional and psychological coping strategies
	2.3 High expectations and hopes for the PFO closure procedure
	2.4 Concerns and uncertainties about the effectiveness of the operation
3. Symptom Outcomes	3.1 Physical and mental health challenges caused by chronic migraines
	3.2 Social and occupational disruptions due to migraine symptoms
	3.3 Seeking professional medical and psychological support
	3.4 Long-term adaptation and resilience strategies

Theme 1: Symptom Perception

This theme encapsulates the diverse experiences of migraine episodes as perceived by patients with PFO. The perception of migraine headaches varies significantly based on individual differences, attack patterns, severity, and other contributing factors.

Subtopic 1: Variability in Migraine Severity and Frequency

Participants reported that migraine attacks are often triggered by specific factors, including fatigue, agitation, and irritability. The frequency and intensity of migraines varied widely among individuals.

Participant 1: If I am tired or in a bad mood, I will have migraines 2 or 3 times a month (more than usual).

Participant 5: Triggers, like when I am tired, or in a stuffy environment like this, I am starting to feel a bit of pain again (laughs), or if I have not slept well, or if I have been in the sun, all of these can trigger migraines.

Participant 6: I experience migraines about once a month, which typically lasts around a week. This is the least frequent; if I am tired, in a bad mood, or under any kind of stress, it's possible for them to occur two or three times a month. Each episode usually lasts between one to two days.

Participant 7: During the least frequent periods in a month, I have migraines for at least seven or eight days. On more frequent occasions, it's every two days; sometimes it's daily. The duration of each migraine varies; it's always at least two hours long, sometimes lasting for several hours, half a day, or most of the night.

Participant 15: Two years ago, my migraines were not very frequent, occurring about once or twice a month. Recently, they have become a bit more frequent—sometimes once or twice a day, and at times, once or twice every two days. The duration is usually around 10 minutes; they do not last long.

Subtopic 2: Triggers and Warning Signs of Migraine Attacks

Participants identified a range of triggers and warning signs that preceded their migraine attacks. These included physical, emotional, and environmental factors.

Participant 3: I can feel it coming when my vision gets blurry or I see flashes of light. That's my warning sign to take medication immediately.
Participant 8: Stress is a big trigger for me. If I am overwhelmed at work or have a lot on my mind, I know a migraine is likely to follow.
Participant 12: Certain foods, like chocolate or cheese, always seem to bring on a migraine for me.
Participant 14: Sometimes I feel fine all day, but around 4 or 5 PM, the pain starts to kick in.
Participant 16: I have a strong impression that during this time in winter, the pain is particularly intense. In the summer, it's not as noticeable; it might occur once a month or once every two months. But in winter, when I have migraines, they can last for one or two days, or even 4 or 5 days.

Subtopic 3: Impact of Environmental and Lifestyle Factors on Symptom Onset

Environmental and lifestyle factors played a significant role in the onset and exacerbation of migraine symptoms. Participants highlighted how changes in their surroundings or daily habits influenced their migraine experiences.

Participant 4: I have noticed that changes in weather, especially sudden drops in temperature, can trigger a migraine for me.
Participant 7: If I do not maintain a regular sleep schedule, I am much more likely to have a migraine the next day.
Participant 10: Being in a noisy or crowded place for too long often leads to a migraine. I try to avoid such environments whenever possible.
Participant 12: My head feels swollen, just bloated. Anyway, when it hurts, I always feel weak. As for the intensity, sometimes I can endure it, but other times I cannot.
Participant 14: I feel a bit dizzy, and then my heart starts to panic, and then I cannot stand steadily. (It feels like something is spinning inside my head, and my limbs are weak).
Participant 15: When I feel nauseous and want to vomit, it's like I am about to die, I cannot control it, and my eyes hurt too.
Participant 16: It hurts with each pulse, like a stabbing pain, with each beat it hurts, but the pain feels like being pricked by a needle, it's quite severe.

Theme 2: Symptom Management

This theme reflects the various strategies patients adopt to cope with migraines, including pharmacological and non-pharmacological interventions, as well as their expectations and concerns regarding the PFO closure procedure.

Subtopic 1: Persistent Efforts to Alleviate Migraine Symptoms (Eg, Medication, Lifestyle Adjustments)

Participants employed a range of strategies to manage their migraine symptoms, including medication, rest, and lifestyle modifications. Despite these efforts, many reported incomplete or temporary relief.

Participant 2: I have tried multiple medications over the years, but none seem to work consistently for me. My neurologist prescribed triptans, but they only dull the pain slightly. The only reliable relief I have found is lying in a dark, quiet room and sleeping it off. Even then, the migraine often returns after a few hours.
Participant 4: After my PFO diagnosis, I took a month's medical leave to focus on recovery. I noticed a significant improvement when I prioritized sleep—going to bed by 10 PM and avoiding screens. I also cut out caffeine, alcohol, and processed foods. Now, if I feel a migraine coming, I immediately rest with an ice pack. It's not perfect, but the attacks are less severe.
Participant 8: I take painkillers whenever I have a headache. If I do not take them, it can last for about an hour. In other words, the pain subsides when I wake up after falling asleep. I just take the painkillers and go to sleep, and I feel better after I have slept.

Subtopic 2: Emotional and Psychological Coping Strategies

Participants described emotional and psychological strategies to manage the stress and frustration associated with chronic migraines.

Participant 3: I try to stay calm and avoid stress as much as possible. Stress makes my migraines worse, so I focus on mindfulness and relaxation techniques.

Participant 6: When the pain gets unbearable, I remind myself that it will pass eventually. It's tough, but staying positive helps me get through it.

Participant 10: I have learned to accept that migraines are part of my life, but I also make sure to take breaks and prioritize self-care.

Subtopic 3: High Expectations and Hopes for the PFO Closure Procedure

All participants expressed high expectations for the PFO closure procedure, hoping it would provide significant or complete relief from their migraines.

Participant 1: Initially, I believed the issue was with my cervical spine, but later, when I consulted the neurology department, I was told it was migraines. I have had a migraine diagnosis for quite some time, but this time it was confirmed. In any case, undergoing the sealing operation is definitely better than not doing it, as I still need to prevent future occurrences. My goal is to achieve a state where I no longer experience pain.

Participant 8: When I was at the clinic, I was informed that operation was necessary and that medication was not very effective. I just wanted to stop having this eye issue, which is a result of my migraines causing eye pain and tears. I had the operation yesterday and experienced a few headaches today, but I am taking it one step at a time.

Participant 9: It definitely works. I have suffered from headaches for many years and have gone through numerous tests, but none of them provided relief. Since the closure operation, I have only had pain once.

Subtopic 4: Concerns and Uncertainties About the Effectiveness of the Operation

Despite their hopes, some participants expressed concerns and uncertainties about the effectiveness of the PFO closure procedure.

Participant 5: I am hopeful that the operation will help, but I am also worried that it might not work for me. I have tried so many things in the past, and nothing has completely resolved my migraines.

Participant 7: I am not entirely sure if the operation will be the solution. I have heard mixed results from others who've had it done, so I am trying to keep my expectations realistic.

Participant 15: The idea of the operation is promising, but I am concerned about potential side effects or complications. It's a big decision, and I am still weighing the pros and cons.

Theme 3: Symptom Outcomes

This theme explores the multifaceted impact of migraines on patients' lives, including physical and mental health challenges, social and occupational disruptions, and their efforts to seek professional support and develop long-term adaptation strategies.

Subtopic 1: Physical and Mental Health Challenges Caused by Chronic Migraines

Chronic migraines had significant physical and psychological effects on participants, including pain, anxiety, depression, and insomnia.

Participant 1: I find it nearly impossible to feel completely relieved from my migraines without absolute silence, which is incredibly frustrating.

Participant 9: It will not affect sleep, but it will affect emotions, such as anxiety.

Participant 14: Anxiety, if you are sick, you just feel anxious.

Participant 16: Actually, it's quite painful. I struggle to sleep well, and when I cannot sleep, I am unable to do anything I'd like to. It keeps hurting and I just focus my attention on the pain.

Subtopic 2: Social and Occupational Disruptions Due to Migraine Symptoms

Migraines disrupted participants' social lives and work, often forcing them to rest or withdraw from daily activities.

Participant 4: At that time of migraine attack, it is necessary to rest, which can also greatly affect some work.
Participant 7: Once you have a headache, you will not be able to sleep well. Additionally, it's inconvenient to travel and drive, which inevitably affects my daily activities. Moreover, as I have to take care of my children, speaking becomes a challenge, and overall, life is impacted significantly.
Participant 11: I struggle to sleep well, and when I cannot sleep, I am unable to do anything I'd like to. It keeps hurting and I just focus my attention on the pain.

Subtopic 3: Seeking Professional Medical and Psychological Support

Participants expressed a strong desire for professional support to manage their migraines, often seeking medical advice and exploring various treatment options.

Participant 5: Are painkillers considered supportive? (Laughing). People who have not experienced it do not understand. They just say, "You go rest, maybe you'll be fine after a nap. (Hopefully) there will be a targeted solution to solve the problem." I am having a headache right now.
Participant 6: I once hung up with a senior expert's account, and when he asked about my situation, I kept talking. He needs to be helpful for my (condition).
Participant 9: No one has told me how to relieve, prevent, and solve problems with my eyes and headaches, but the doctor will introduce me to things about occlusion operation, but everyone's symptoms are different. If there is comprehensive help, it is better, and I can match the person's seat.
Participant 13: I searched a lot of information online and followed what was said online (to relieve migraines), but it did not work. It would be great if doctors and nurses had better methods, after all, they are professionals.

Subtopic 4: Long-Term Adaptation and Resilience Strategies

Participants developed various strategies to adapt to living with chronic migraines, demonstrating resilience in managing their condition.

Participant 3: I try to stay calm and avoid stress as much as possible. Stress makes my migraines worse, so I focus on mindfulness and relaxation techniques.
Participant 6: When the pain gets unbearable, I remind myself that it will pass eventually. It's tough, but staying positive helps me get through it.
Participant 10: I have learned to accept that migraines are part of my life, but I also make sure to take breaks and prioritize self-care.
Participant 14: Since the closure operation, I have only had pain once. I am hopeful that this is a long-term solution, but I am also prepared to continue managing my migraines if needed.

Discussion

This study explored the migraine experiences of patients with PFO, focusing on three key themes in the context of SMT: Symptom Perception, Symptom Management, and Symptom Outcomes. Below, we discuss each of these themes in detail, with a focus on how the findings contribute to our understanding of the migraine experience in this patient population.

Symptom Perception

Our findings indicate that 63% of the participants had long-term migraine experiences prior to the diagnosis of PFO, which was often difficult to link to a specific etiology.Patients presented with clinically significant migraine severity (mean VAS 5.2 ± 1.8, indicating moderate symptoms), a quantitative measure that contextualizes their persistent symptom burden. This aligns with the "Symptom Perception" dimension of SMT, where the prolonged nature of the symptoms contributes to heightened negative perceptions and emotional distress. Patients expressed confusion over the causes of their symptoms, as they frequently visited various departments without receiving a clear diagnosis. The inability to identify a cause for their migraines exacerbated their distress, contributing to negative emotional outcomes.

Previous research supports this, showing that patients with unexplained chronic pain often experience higher levels of frustration and psychological distress.[26]

Regarding migraine triggers, patients reported a high degree of variability in the frequency and intensity of attacks. Common triggers included environmental factors such as light, noise, and stress, as well as lifestyle factors like sleep patterns, diet, and physical activity. These findings are consistent with prior studies that emphasize the complex relationship between migraine occurrence and environmental and lifestyle influences. Research has shown that external stimuli, including noise and light, as well as factors such as irregular sleep and poor diet, can significantly impact migraine onset and severity.[27,28] This variability highlights the importance of personalized care strategies that take into account individual triggers and the unique constellation of factors influencing migraine experiences in each patient.

Additionally, the impact of environmental and lifestyle factors on migraine frequency and severity underscores the need for a holistic approach to treatment. As suggested by the European Stroke Organization (ESO) and Chinese expert consensus guidelines, a comprehensive, multidisciplinary approach that addresses both the physical and psychological factors contributing to migraines may be crucial in improving patient outcomes.[29–31] These guidelines advocate for screening individuals with refractory migraines or ischemic cerebrovascular disease for PFO, suggesting that a thorough, individualized assessment can aid in identifying and addressing key contributors to migraine symptoms.

Symptom Management

The Symptom Management theme focuses on the ongoing efforts by patients to alleviate their migraine symptoms. In this study, patients employed various strategies, such as pharmacological treatments, lifestyle adjustments, and psychological coping mechanisms, although many of these efforts yielded limited success. Prior to their diagnosis of PFO, most patients primarily relied on medications, with little attention given to the underlying causes of their migraines or the emotional components that might contribute to symptom exacerbation. This observation aligns with findings from other studies, which suggest that migraine patients often receive insufficient management, particularly in addressing the multifaceted nature of the condition.[32] For example, it is well-established that a one-dimensional approach to treating migraines, such as focusing solely on pharmacological interventions, fails to address the psychological, environmental, and lifestyle factors that may be contributing to the condition.[33,34]

In addition to medication, patients in this study employed emotional and psychological coping strategies, including stress-reduction techniques such as mindfulness and relaxation exercises. Despite these efforts, many patients reported persistent anxiety and frustration related to the chronic nature of their symptoms and the perceived lack of effective treatments. This finding supports the notion that migraines are not solely a physical condition but also involve significant emotional and psychological components.[35] Previous research has demonstrated that emotional distress can amplify the perception of pain, thus creating a vicious cycle where pain intensifies emotional suffering, and vice versa.[36] This underscores the need for a comprehensive, holistic approach to migraine management, one that recognizes and addresses both the physical and emotional aspects of the condition.[37,38]

Moreover, many patients in this study expressed high expectations for the PFO closure procedure, hoping it would provide long-term relief from their migraines. This aligns with the findings of other studies examining procedural interventions, where patients often place substantial hope in surgeries or other medical interventions to resolve chronic conditions.[39] However, despite their hopes, some patients voiced concerns and uncertainties about the procedure's effectiveness in addressing their migraines. These mixed expectations highlight the importance of clear and thorough preoperative education to manage patient expectations and provide the necessary emotional support both before and after the procedure.[40] Setting realistic expectations through education can help patients cope with the uncertainties surrounding the procedure and mitigate any potential disappointment or frustration.

Symptom Outcomes

The Symptom Outcomes theme reflects the significant physical and emotional challenges that patients experience due to chronic migraines. Many patients reported physical health challenges such as debilitating pain, fatigue, and sleep disturbances. These symptoms were described as severely limiting their daily activities and overall quality of life. Additionally, mental health challenges such as depression and anxiety were frequently reported, exacerbated by the

chronic nature of the migraines. This is consistent with previous literature, which demonstrates the high comorbidity of migraines with psychiatric conditions such as depression and anxiety.[33,37]

Furthermore, social and occupational disruptions were evident in the lives of many patients. Several reported difficulty performing their work duties, which impacted their professional lives, while others experienced strain in their personal relationships due to the unpredictability and severity of their migraine attacks. This finding is consistent with studies showing that migraines can lead to significant social isolation, economic hardship, and impaired social functioning.[41,42] The cumulative impact on quality of life underscores the need for comprehensive interventions that address not just the physical aspects of the condition but also the social and occupational consequences.

In terms of seeking professional medical and psychological support, more than 90% of the participants in this study reported seeking assistance from healthcare providers. This highlights the importance of multidisciplinary support in managing chronic conditions like migraine, which require a holistic approach to treatment. Patients expressed a desire for more psychosocial support in addition to medical interventions, highlighting the need for a more integrated care model. Studies have shown that involving multidisciplinary teams—consisting of neurologists, psychologists, and pain management specialists—can improve treatment outcomes for patients with chronic migraine.[29,30]

Patients also demonstrated long-term adaptation and resilience strategies as they learned to cope with the ongoing nature of their migraines. Many patients reported developing personal strategies for managing their migraines, such as avoiding certain triggers and adhering to medication regimens. However, the lack of a standardized, comprehensive management model for the non-painful symptoms and psychological issues associated with migraines remains a barrier to effective care. This gap in care can be addressed through digital health technologies, which have been shown to provide valuable support in managing chronic pain and related psychological issues.[39,43]

Implications for Practice

The findings of this study suggest several key implications for clinical practice. First, healthcare providers should consider a multidisciplinary approach when managing patients with PFO and migraines, ensuring that physical, emotional, and social aspects of the condition are addressed comprehensively. This approach should include personalized treatment plans that take into account individual triggers, lifestyle factors, and emotional well-being.

Second, patient education plays a critical role in improving self-management. Providing patients with information about migraine triggers, self-care strategies, and the potential benefits and risks of PFO closure procedures can help set realistic expectations and empower patients to take an active role in their care. Moreover, improving patients' self-management abilities through education can enhance their coping strategies and reduce their reliance on medical interventions.

Lastly, the integration of digital health tools could play a significant role in enhancing patient care. Mobile health applications, virtual reality programs, and digital platforms that offer personalized pain management, sleep support, and emotional well-being strategies could provide much-needed resources for patients struggling with chronic migraines.

Study Limitations

This study has several limitations that should be considered when interpreting the findings. First, the study was conducted at a single hospital, which may limit the generalizability of the results. Additionally, the interviews were conducted within six months following the PFO occlusion procedure, meaning the long-term impact of the procedure on migraine experiences was not captured. Future research should aim to include a broader sample of participants from different regions and track patients over a longer period to gain a more comprehensive understanding of the long-term outcomes of PFO closure on migraine management.

Conclusion

This study demonstrates that PFO patients experience clinically significant migraine burden, with moderate symptom severity compounded by emotional distress. Their symptom perception and management strategies - particularly the prolonged diagnostic uncertainty and psychological impacts - align directly with SMT's theoretical framework, confirming the interplay between physical symptoms and cognitive-emotional responses.

These findings advocate for integrated care models combining: (1) targeted pain management (guided by VAS quantification), (2) psychological support, and (3) multidisciplinary coordination. Future research should validate these approaches through longitudinal studies tracking VAS trajectories post-PFO closure, while expanding demographic diversity to strengthen generalizability.

Abbreviations

PFO, Patent Foramen Ovale; SMT, Symptom Management Theory; COREQ, Consolidated Criteria for Reporting Qualitative Research; VAS, Visual Analogue Scale.

Data Sharing Statement

The datasets analyzed during the current study are not publicly available due to ethical and privacy reasons.

Ethical Approval and Consent to Participate

This study was reviewed and approved by the Ethics Committee of the Third People's Hospital of Henan Province (Ethics Number: 2025SZSYLCYJ0301). All participants were fully informed about the purpose, procedures, potential risks, and benefits of the study, and written informed consent was obtained prior to participation. The study was conducted in accordance with the principles of the Declaration of Helsinki and other relevant ethical guidelines. Participants were assured of their right to withdraw from the study at any time without consequence, and their confidentiality was strictly maintained throughout the research process.

Consent for Publication

In cases where identifiable patient features (eg, patient quotes) are included in this manuscript, written consent for publication was obtained from all participants involved. The participants were informed that their data might be published in scientific journals, and they agreed to the use of their information for this purpose.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors declare that they have no competing interests in this work.

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