Alleviating Effects of Perioperative Psychological Intervention and Distraction Therapy on Discomfort in Patients Undergoing Combined Minimally Invasive Treatment for Lower Limb Varicose Veins

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AIM: To investigate the alleviating effects of perioperative psychological intervention combined with distraction therapy on discomfort in patients undergoing combined minimally invasive treatment for lower limb varicose veins.

METHODS: In this retrospective study, 150 patients with lower limb varicose veins who underwent combined minimally invasive treatment at The Affiliated Hospital of Xuzhou Medical University from January 2023 to June 2024 were included. The patients were divided into an observation group (73 cases) and a control group (77 cases) according to the type of perioperative nursing treatments received. Both groups of patients received routine intravenous analgesics during the procedure. The control group received routine intraoperative care, while the observation group underwent perioperative psychological intervention and distraction therapy on the basis of routine care. The Visual Analog Scale (VAS) pain scores were compared between the two groups at key procedural time points, including great saphenous vein trunk closure, local vein excision, and sclerosant injection. The Self-Rating Anxiety Scale (SAS) scores at multiple time points, heart rate, blood pressure fluctuations, and postoperative patient satisfaction were evaluated and compared.

RESULTS: The VAS scores at each time point in the observation group were significantly lower than those in the control group ($p < 0.001$). The SAS scores at the pre- and post-operatively were significantly lower in the observation group than in the control group ($p < 0.05$). The heart rate, systolic blood pressure, and diastolic blood pressure fluctuation during the surgery were smaller in the observation group than in the control group ($p < 0.001$). The patient satisfaction rate in the observation group significantly exceeded that in the control group (97.26% vs 83.12%, $p < 0.05$).

CONCLUSIONS: Perioperative psychological intervention combined with distraction therapy provides a potential strategy to alleviate preoperative anticipatory anxiety in patients with lower limb varicose veins undergoing combined minimally invasive treatment. By employing various intraoperative methods to divert patients' attention from pain, this approach may further alleviate overall discomfort. These findings suggest that this strategy is associated with favorable outcomes and may warrant further investigation for clinical application.

Keywords: lower limb varicose vein; combined minimally invasive treatment; perioperative period; psychological intervention; distraction therapy

Introduction

Lower limb varicose veins are a common chronic progressive venous disease affecting millions of people worldwide [1–3]. Several epidemiological studies have reported that the prevalence of lower limb varicose veins is approximately 8.89% in China [4], with incidence increasing markedly with age and reaching up to 55.7% among individuals aged 55–64 years [5]. The primary pathogenic factors of lower limb varicose veins include weak venous walls, incompetent venous valves, and elevated venous pressure in the lower limbs, with prolonged standing or sitting, obesity, pregnancy, and familial genetics constituting some of the important risk factors for this condition [6–8]. Its main clinical manifestations include leg discomfort, pain, swelling, and thrombus formation, which lead to lower limb dysfunction, adversely impacting the affected patients' quality of life in physiological, psychological, and social dimensions [9,10].

Treatment options for lower limb varicose veins are diverse, but surgical intervention presents conspicuous drawbacks such as significant trauma and postoperative pain. With the advancements in medical and surgical technologies, recent years have seen the emergence of minimally invasive surgical approaches, such as endovenous laser ablation (EVLA), which have gradually replaced the conventional treatment options [11,12]. However, implementation of only a type of minimally invasive method is limited by its efficacy, and thus, according to multiple studies, combined mini-

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mally invasive treatment regimens offer a higher level of therapeutic effectiveness [13–15]. In our center, closure of the great saphenous vein trunk, varicose vein excision, and foam sclerotherapy are conducted on the patients under local anesthesia. Despite the application of intravenous analgesia during the procedure, patients may still experience discomfort such as pain, elevated blood pressure, and increased heart rate due to tension. This necessitates modifications to the treatment regimens in order to enhance postoperative satisfaction among the patients.

The current mode of management for varicose veins is mainly grounded in clinical perioperative interventions focused on promoting postoperative recovery and health education [16–18], without placing sufficient emphasis on improving preoperative psychological states and mitigating intraoperative stress responses. Multiple studies have shown that perioperative psychological intervention has a positive impact on improving patient anxiety [19,20], and distraction therapy can alleviate intraoperative discomfort in patients undergoing local anesthesia procedures [21–24]. Thus, the present study aims to conduct a rigorous retrospective analysis of patients undergoing combined minimally invasive treatment for lower limb varicose veins to explore the specific impact of perioperative psychological intervention combined with multimodal distraction therapy on their intraoperative and short-term postoperative discomfort and stress response. The findings of this investigation will provide a reliable evidence-based medical basis for precisely optimizing clinical nursing care protocols for managing discomfort confronted by these patients.

Methods

General Information

This study was a retrospective cohort study conducted at Department of Interventional Radiology of The Affiliated Hospital of Xuzhou Medical University. The research protocol was approved by the Ethics Committee of The Affiliated Hospital of Xuzhou Medical University (XYFY2024-KL272-02). One hundred and fifty patients with lower limb varicose veins who underwent combined minimally invasive treatment at The Affiliated Hospital of Xuzhou Medical University from January 2023 to June 2024 were retrospectively included. The patients were divided into an observation group ($n = 73$, receiving perioperative psychological intervention + distraction therapy + routine care) and a control group ($n = 77$, receiving routine care only). Inclusion criteria of this study are as follows: (1) patients who met the diagnostic criteria for lower limb varicose veins according to the "Diagnosis and Treatment Guidelines for Chronic Venous Diseases of the Lower Limb (2019)" [4], confirmed by lower limb color Doppler ultrasound and classified as Clinical, Epidemiological, Anatomical, and Pathophysiological Classification (CEAP) C2-C4, as per the Clinical, Epidemiological, Anatomical, and Pathophysiological Classification [25]; (2) patients scheduled to undergo combined treatment including closure of the great saphenous vein trunk, local vein excision, and foam sclerotherapy; (3) patients with clear consciousness and normal auditory, visual, and language communication abilities; (4) patients who had not used analgesics, sedatives, or anti-anxiety medications within 1 week prior to the procedure; and (5) patients who provided informed consent for the treatment and care plan and were able to comply with the full assessment and follow-up.

Exclusion criteria of this study are as follows: (1) patients with severe cardiovascular or cerebrovascular diseases, hepatic or renal insufficiency, coagulation disorders, or malignant tumors; (2) patients with a history of mental illness, cognitive impairment, or inability to complete scale assessments; (3) patients with hearing or visual impairments or clear contraindications to audio or video-based interventions; (4) patients with known allergies to flurbiprofen axetil injection or components of foam sclerotherapy; (5) pregnant or lactating women; (6) patients who had undergone lower limb venous-related surgery or other invasive treatments in the past three months; and (7) patients with concomitant deep vein thrombosis, peripheral arterial disease, or other vascular diseases.

The observation group comprised 39 males and 34 females, and the patients in this group were aged 35–70 years (mean, 52.3 ± 7.3 years). According to the CEAP classification, there were 27 cases of C2, 31 cases of C3, and 15 cases of C4. The control group comprised 40 males and 37 females, aged 33–69 years (mean, 51.9 ± 7.0 years), with 29 cases of C2, 35 cases of C3, and 13 cases of C4. There were no statistically significant differences between the two groups in terms of gender, age, and CEAP classification ($p > 0.05$). Details are presented in Table 1.

Psychological Intervention Versus Routine Perioperative Care

This study is a retrospective analysis comparing commonly used perioperative nursing care protocols in The Affiliated Hospital of Xuzhou Medical University. Patients were categorized into an observation group (73 cases) and a control group (77 cases) based on the nursing care protocols they received. Both groups of patients received intravenous analgesics according to a standardized protocol during the procedures, consisting of flurbiprofen axetil injection at a dose of 1 mg/kg, with an additional half dose administered if the duration of the surgery exceeded 1 hour.

Within the control group, patients received routine intraoperative care, including preoperative education about the procedural aspects, positioning requirements, and precautions of the combined minimally invasive treatment. Nursing staff maintained a quiet operating room environment and promptly responded to patients' needs.

In addition to routine care, patients in the observation group were retrospectively identified as having received perioperative psychological intervention and distraction therapy as

Table 1. Comparison of baseline data of patients.

Indicator	Observation group (n = 73)	Control group (n = 77)	Statistical value	p-value
Gender (male/female)	39/34	40/37	$\chi^2 = 0.033$	0.856
Age (years)	52.3 ± 7.3	51.9 ± 7.0	$t = 0.343$	0.732
Duration of illness (years)	7.8 ± 2.1	7.5 ± 2.3	$t = 0.833$	0.406
BMI (kg/m²)	24.1 ± 1.8	23.9 ± 1.9	$t = 0.661$	0.510
CEAP classification (C2/C3/C4)	27/31/15	29/35/13	$\chi^2 = 0.350$	0.839
Affected side (left/right/bilateral)	29/30/14	31/29/17	$\chi^2 = 0.267$	0.875
Baseline SAS score (points)	55.9 ± 5.6	55.8 ± 5.7	$t = 0.108$	0.913

Abbreviations: BMI, body mass index; CEAP, Clinical, Epidemiological, Anatomical, and Pathophysiological Classification; SAS, Self-Rating Anxiety Scale.

part of their care plan. According to the nursing records, the following interventions were implemented:

1. Preoperative Psychological Intervention Module (from the day before surgery until entering the operating room)

1.1 Psychological state assessment: The Self-Rating Anxiety Scale (SAS) was used to assess preoperative anxiety levels. Core sources of anxiety, such as concerns about surgical safety, fear of intraoperative pain, and worries about postoperative cosmetic outcomes, were identified based on the records.

1.2 Targeted cognitive intervention: Personalized education was provided to the patients based on the identified anxiety triggers. This was achieved by utilizing visual aids to explain the technical advantages, procedural details, and safety profile of the combined minimally invasive treatment. Emphasis was placed on the minimally invasive nature of the surgery, pain management measures, and rapid postoperative recovery. For patients concerned about postoperative aesthetics, information was provided regarding the minimal and concealed scarring associated with the procedure.

1.3 Enhanced intervention on the day of surgery: Nursing records indicated that patients received additional psychological support 30 minutes before entering the operating room, including reassessment of anxiety levels using SAS and one-on-one counseling for those with persistent anxiety.

2. Preoperative Distraction Therapy

Although details regarding the specific audio- or video-based interventions and distraction devices utilized (e.g., decompression ball) were not consistently recorded, nursing notes suggested that these patients were offered various forms of distraction therapy, including auditory and tactile interventions, to divert attention from the surgical procedure.

3. Intraoperative Distraction Therapy

For patients who received auditory distraction treatment, noise-canceling headphones were used to play pre-selected audio, as noted in the records. The volume was adjusted to ensure audibility without interfering with medical staff instructions. On the other hand, patients receiving tactile intervention were guided to perform rhythmic "squeeze-relax" exercises with a decompression ball, as documented in the nursing notes, particularly during stages associated with strong pain stimuli. Some patients who received visual-based intervention were provided with video content displayed on an adjustable-angle screen, as noted in retrospective accounts; however, specific details such as screen distance and volume settings were not uniformly recorded. All intervention operations were performed by operating room nurses who had undergone standardized training covering the characteristics of combined minimally invasive treatment for lower limb varicose veins, perioperative intervention procedures, communication skills, and equipment operation. Data were independently extracted by two researchers who cross-checked to ensure accuracy. During statistical analysis, group identifiers were encoded (e.g., Group A and Group B) to minimize bias. Although complete blinding to group allocation was challenging in this retrospective study, efforts were made to maintain objective data interpretation.

Observational Indicators

1. Subjective Discomfort Scores

Pain Score: The Visual Analog Scale (VAS) was used to assess pain at different time points: after closure of the great saphenous vein trunk (T1), after local vein excision (T2), and upon completion of foam sclerotherapy (T3). The VAS scale has a score range of 0–10 points, where 0 indicates no pain, 1–3 mild pain, 4–6 moderate pain, 7–9 severe pain, and 10 intense pain.

Anxiety Score: The SAS was utilized to evaluate anxiety levels one day before surgery (T0), before the start of surgery (T1), and upon completion of surgery (T4). The scale consists of 20 items, with each scored from 1 to 4 points. The total score was converted into a standard score using this formula: Standard score = Original score × 1.25. A standard score of ≥50 indicates the presence of anxiety, with higher scores indicating increased anxiety severity.

2. Fluctuation in Vital Signs

Heart rate, systolic blood pressure (SBP), and diastolic blood pressure (DBP) were recorded at T0, T1, T2, and T3 time points. The fluctuation magnitude was calculated as follows: fluctuation magnitude = maximum value during the procedure (T1, T2, or T3) - baseline value before the procedure (T0).

3. Patients' Satisfaction

An in-house scale called the "Surgical Care Satisfaction Scale" was utilized to assess patient satisfaction upon discharge. The scale encompasses three dimensions: nursing attitude, intervention effectiveness, and medical experience, with a total of 15 items scored on a 5-point Likert scale. The scale has a total score of 75 points, with a score of ≥60 indicating 'very satisfied', 45–59 'satisfied', and <45 'dissatisfied'. Satisfaction rate was calculated using the following formula:

Satisfaction rate (%) = [(Number of patients feeling very satisfied + Number of patients feeling satisfied) / Total number of patients] × 100.

This scale was developed based on a previously published patient satisfaction survey tool and was reviewed by our senior nursing experts before implementation. However, as it is not a nationally standardized tool, potential measurement deviations cannot be completely ruled out.

Statistical Analysis

Data analysis was performed using SPSS (26.0, International Business Machines Corporation, Armonk, NY, USA) statistical software. The Shapiro–Wilk test was used for normality testing to determine whether the quantitative data conform to normal distribution. Normally distributed continuous data were expressed as mean ± standard deviation (SD). Independent samples *t*-tests were performed for inter-group comparisons, while repeated measures analysis of variance (ANOVA) was utilized to assess differences across time points within groups. The Sphericity test was first performed, and if the assumption was violated, the Greenhouse–Geisser correction was applied. Categorical data were presented as counts and percentages, and inter-group comparisons were conducted using the chi-square test. A significance level of $p < 0.05$ was considered statistically significant.

Results

Comparison of SAS Scores at Different Time Points

The *F*-value of the time factor represents the overall change in SAS scores at different surgical stages, while the *F*-value of the group factor reflects the difference between the observation group and the control group. The interaction reflects the combined effect of time and group; *t*-values were derived from independent sample *t*-tests conducted at each time point to compare SAS scores between groups, complementing the results of the ANOVA. At T0, the SAS score in the observation group was significantly lower than that in the control group ($p < 0.001$); at T1, there was no statistically significant difference in SAS scores between the two groups ($p > 0.05$); at T4, the SAS score in the observation group remained significantly lower than that in the control group ($p < 0.001$). Details are presented in Table 2. The statistical results of multiple comparison correction are as follows: for comparison of between-group factors: $F = 245.085/p < 0.001$; for comparison of time factors: $F = 223.536/p < 0.001$; and for comparison of between-group and time interaction factors: $F = 57.561/p < 0.001$.

Comparison of VAS Scores at Different Time Points During Surgery

At T1 (during closure of the great saphenous vein trunk), T2 (during local vein excision), and T3 (upon completion of foam sclerotherapy), the VAS scores in the observation group were significantly lower than those in the control group, with statistical significance ($p < 0.001$). See Table 3 for details. The statistical results of multiple comparison correction are as follows: for comparison of between-group factors: $F = 20.333/p < 0.001$; for comparison of time factors: $F = 446.372/p < 0.001$; for comparison of between-group and time interaction factors: $F = 5.775/p < 0.001$.

Comparison of Intraoperative Heart Rate and Blood Pressure Fluctuations

The observation group exhibited significantly lower fluctuations in terms of heart rate, SBP, and DBP compared to the control group ($p < 0.001$, Table 4).

Comparison of Patient Satisfaction

Patient satisfaction in the observation group was 97.26%, significantly higher than that in the control group (83.12%) ($p < 0.05$), as shown in Table 5.

Discussion

In this retrospective analysis, we noted an apparent declining trend in the SAS score of the observation group starting from the day before surgery to the beginning of surgery. Our research results also indicate that the pain scores of the observation group were significantly lower than those of the control group at each critical stage of surgery, and anxiety was lower than that of the control group at T1 and T4, indicating that perioperative psychological intervention combined with distraction therapy can effectively alleviate patients' discomfort throughout the entire process. These findings not only align with results of the previous research [26,27] but also further confirm the important role of multimodal intervention in optimizing patients' perioperative experience.

During surgery, pain is a core experiential indicator of local anesthesia during a minimally invasive surgery. The results of this study showed that the VAS score of the observation group was significantly lower than that of the control group

Table 2. Comparison of SAS scores at different time points between the two groups.

Group	*n*	T0	T1	T4
Observation group	73	42.3 ± 4.2	56.0 ± 5.9	38.4 ± 3.9
Control group	77	53.0 ± 4.9	55.9 ± 6.0	48.7 ± 4.3
t-value		14.324	0.103	15.340
p-value		<0.001	0.918	<0.001

Table 3. Comparison of VAS scores at different time points during surgery between the two groups.

Group	*n*	T1	T2	T3
Observation group	73	1.7 ± 0.7	2.0 ± 0.8	1.3 ± 0.6
Control group	77	3.6 ± 1.1	3.9 ± 1.3	3.2 ± 1.0
t-value		12.544	10.711	14.016
p-value		<0.001	<0.001	<0.001

Abbreviation: VAS, Visual Analog Scale.

Table 4. Comparison of intraoperative heart rate and blood pressure fluctuations between the two groups.

Indicator	Observation group	Control group	*t*-value	*p*-value
Heart rate fluctuations (bpm)	7.9 ± 2.3	15.1 ± 3.6	14.509	<0.001
SBP fluctuations (mmHg)	10.1 ± 2.6	18.4 ± 3.3	17.050	<0.001
DBP fluctuations (mmHg)	8.4 ± 2.2	15.2 ± 2.9	16.114	<0.001

Notes: The fluctuation magnitude is calculated as the difference between the maximum and minimum values recorded during the continuous monitoring.

Abbreviations: DBP, diastolic blood pressure; SBP, systolic blood pressure.

Table 5. Comparison of patient satisfaction between the two groups.

Group	*n*	Very satisfied, *n* (%)	Satisfied, *n* (%)	Dissatisfied, *n* (%)	Satisfaction rate (%)	χ^2 value	*p*-value
Observation group	73	43 (58.90)	28 (38.36)	2 (2.74)	97.26	8.329	0.004
Control group	77	33 (42.86)	31 (40.26)	13 (16.88)	83.12		

in the three key surgical time points—closure of the great saphenous vein trunk, local vein resection, and completion of foam sclerotherapy. This indicates that, in addition to routine intravenous analgesia, the combination of perioperative psychological intervention and multimodal distraction therapy can further mitigate pain perception. The underlying mechanism of distraction therapy involves the use of multimodal sensory inputs, including auditory, visual, and tactile stimuli, to compete for cognitive resources, thereby reducing cortical attention to nociceptive signals from the surgical site. This process raises the pain threshold and alleviates subjective discomfort. Through auditory, visual, and tactile stimuli, intraoperative multimodal distraction therapy diverts the patient's attention from the surgical procedure, enhances analgesic effects, and helps compensate for the limitations of single-drug analgesia [28–30]. The combination of psychological intervention and distraction therapy exhibits a synergistic effect. Distraction therapy employs multimodal sensory inputs, such as auditory, visual, and tactile stimuli, to compete for cognitive resources, thereby reducing cortical attention to noxious stimuli at the surgical site. This procedure increases the pain threshold and alleviates subjective discomfort. When combined with psychological intervention, the two approaches complement each other, further diverting the patient's attention from the surgical procedure, enhancing analgesic effects, and overcoming the limitations of single-drug analgesia, ultimately reducing the patient's intraoperative pain perception.

Stress response and hemodynamic stability are important indicators of perioperative safety. The observation group showed significantly lower fluctuations in heart rate, SBP, and DBP compared to the control group. This suggests that psychological intervention combined with distraction therapy can effectively inhibit excessive activation of the sympathetic nervous system, reduce catecholamine release, stabilize heart rate and blood pressure, and reduce the potential risks of severe intraoperative fluctuations, particularly suitable for middle-aged and elderly patients with underlying cardiovascular diseases.

Patient satisfaction is a core indicator reflecting the quality of nursing services. The overall satisfaction rate of the observation group (97.26%) was significantly higher than that of the control group (83.12%) (χ^2 = 8.329, p = 0.004). This indicates that systematic, individualized, and comprehensive psychological and distraction interventions can significantly enhance patient comfort, sense of security, and perioperative compliance, while improving doctor–

patient communication and the overall nursing experience, thereby demonstrating important clinical value. However, this study used a self-developed satisfaction scale, the reliability and effectiveness of which have not been fully validated. In addition, the comparability of this scale with equivalent established instruments has not been thoroughly evaluated, possibly due to the lack of standardized criteria, which makes it difficult to directly compare or reference the findings with those of other studies. These limitations may, to some extent, affect the accuracy and generalizability of the conclusions and warrant further investigation and improvement in future research.

The strengths of this study lie in focusing on the key operational points of combined minimally invasive treatment, and the utilization of dynamic, multidimensional assessments (SAS, VAS, vital sign fluctuations, satisfaction). The data are comprehensive and supported by robust statistical analysis, and the intervention protocol is reproducible and suitable for clinical applications. Nevertheless, several limitations of this study should be acknowledged. First, it is a single-center, retrospective study, which may introduce potential selection bias and limit the generalizability of the findings. Second, the limited sample size may reduce statistical power. Third, long-term quality of life was not assessed in this study due to the absence of follow-up data. Furthermore, no stratified comparison was conducted on the efficacy differences between different distraction methods. Finally, there were challenges in obtaining a complete dataset for multimodal distraction therapy due to the inherent limitations of retrospective data collection. In particular, data on patient compliance, audio/video viewing duration, and reasons for non-compliance were not recorded. This limitation may affect the interpretation of results, as higher compliance could potentially lead to better outcomes. Future studies should incorporate compliance monitoring to assess its impact on the effectiveness of perioperative interventions. The distraction therapy was described only in general terms, without specific standardized operational parameters. While heart rate and blood pressure fluctuations were used to indicate stress response, this study lacks data on perioperative stress-related adverse events to provide a bigger picture. Furthermore, this paper lacks an analysis of the proportion of patients who actually received additional doses of flurbiprofen axetil. Without such analysis, we were unable to discern whether additional doses could be a potential confounding factor. In addition, although key intraoperative variables such as surgical duration and specific procedural combinations were not systematically recorded in electronic databases, all surgeries were performed by the same surgical team using standardized minimally invasive protocols, which may partially reduce intergroup outcome heterogeneity. Future research should focus on prospective, multicenter, randomized controlled trials to address these limitations and further optimize intervention strategies. Finally, the satisfaction scale used in this study was independently developed by the research group. Although the scale was designed based on relevant theoretical frameworks and literature review, and has been pre tested, its reliability and validity indicators have not been fully validated in a large sample population, which may have a certain impact on the stability and comparability of the research results. However, due to the lack of horizontal comparison with mature satisfaction scales in similar studies at home and abroad, the conclusions of this study have certain limitations in external application and promotion. Future research should further adopt widely validated standard scales or conduct more systematic reliability and validity evaluations of existing scales to enhance the comparability and universality of research results.

Conclusions

Our retrospective findings suggest that perioperative psychological interventions combined with multimodal distraction therapy may mitigate intraoperative pain and anxiety levels, stabilize hemodynamic parameters, and improve satisfaction in patients undergoing combined minimally invasive treatment for lower limb varicose veins. While these results are promising, they should be interpreted with caution given the retrospective study design. Prospective, randomized controlled trials are warranted to confirm these findings and establish the clinical utility of this integrated care approach.

Availability of Data and Materials

The data analyzed are available from the corresponding author upon reasonable request.

Author Contributions

YW designed the research study and wrote the manuscript. ZZ performed the research and analyzed the data. Both authors have been involved in revising the manuscript critically for important intellectual content. Both authors gave final approval of the version to be published. Both authors have participated sufficiently in the work to take public responsibility for appropriate portions of the content and agreed to be accountable for all aspects of the work in ensuring that questions related to its accuracy or integrity.

Ethics Approval and Consent to Participate

This study is in accordance with the Declaration of Helsinki. The study was approved by the Ethics Committee of The Affiliated Hospital of Xuzhou Medical University (XYFY2024-KL272-02). The principle of informed consent was followed throughout the experiment, and information about the study was provided to patients or their families, and consent was obtained.

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Conflict of Interest

The authors declare no conflict of interest.

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