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ORIGINAL RESEARCH

Analysis of the Current Status of Acute Postoperative Pain and Influencing Factors of Moderate to Severe Pain in Adult Patients Undergoing Ophthalmic Surgery Under General Anesthesia

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Objective: This study aims to assess the current status of acute postoperative pain in adult patients undergoing ophthalmic surgery under general anesthesia and to identify factors associated with moderate to severe postoperative pain, thereby offering insights for improving pain management in ophthalmic surgical patients.

Methods: A cross-sectional survey was conducted on 437 adult patients who underwent general anesthesia surgery in the Ophthalmology Department of West China Hospital, Sichuan University. The survey included a general information questionnaire, the Numerical Rating Scale (NRS) for pain, the Huaxi Emotional-Distress Index (HEI) questionnaire, and the Athens Insomnia Scale (AIS).

Results: The incidence of acute postoperative pain was 95%, with a mild pain incidence of 45.5% and a moderate to severe pain incidence of 49.6%. The average time for postoperative pain to intensify to moderate to severe was 1.50 hours. The possibility of moderate to severe postoperative pain in people over 60 years old was 46% lower than that in people under 60 years old; the possibility of moderate to severe postoperative pain in ethnic minorities was 2.7 times that of Han people; the possibility of postoperative pain in patients undergoing orbital plastic surgery and enucleation of ocular contents+ implantation of ocular prosthesis was 2.64 times and 4.92 times that of those undergoing orbital tumor resection, respectively; the possibility of moderate to severe postoperative pain in patients with suspected insomnia and insomnia was 5.76 times and 12.31 times that of those without sleep disorders, respectively.

Conclusion: The incidence of acute postoperative pain in adult patients undergoing general anesthesia in ophthalmology is relatively high. Age, ethnicity, surgical methods, and sleep quality are influencing factors of moderate to severe postoperative pain. Medical staff should further strengthen pain management by addressing these influencing factors to reduce the incidence of moderate to severe postoperative pain in patients.

Keywords: ophthalmology, general anesthesia surgery, acute pain, influencing factors

Introduction

Acute postoperative pain is a common postoperative symptom in clinical practice and a global medical concern.[1] In 2022, the National Health Commission of China issued the "Notice on Printing and Distributing the Pilot Work Plan for Comprehensive Pain Management",[2] aiming to improve the quality of comprehensive pain management medical services. Safe and effective pain management is a key link in promoting rapid postoperative recovery.[3] Studies show that over 70% of postoperative patients in the UK,[4] the US,[5] and China[6] have experienced moderate to severe pain. Inadequate control of acute postoperative pain can lead to complications such as hospital-acquired pneumonia and poor wound healing, delay postoperative recovery, and increase the economic burden on patients[4,7,8]. Effective control of acute postoperative pain is of great significance in reducing the occurrence of complications and promoting the early recovery of patients.[9]

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In the postoperative rehabilitation management of surgery, pain is a core indicator affecting the prognosis of patients, and its effective control has become an important standard for measuring medical quality. Currently, local anesthesia surgery is the mainstream in ophthalmology clinical practice. This type of surgery has small trauma and relatively mild postoperative pain. In the long-term practice, it has gradually led medical staff to form a mindset that "the pain risk of ophthalmic surgery is low". Ophthalmic surgery is a highly specialized surgery in the field of surgery, with the ocular surface and periorbital tissues rich in nerve endings (the distribution of the ophthalmic branch of the trigeminal nerve). Surgical stimulation can easily cause significant acute pain responses. However, in clinical practice, postoperative pain management has not been a focus of attention. More notably, although adult patients undergoing ophthalmic surgeries under general anesthesia account for a relatively small proportion, most of them have larger surgical trauma and more complex operations, such as those involving orbital tumors, orbital plastic surgery, and enucleation of eyeball, enucleation of ocular contents+ Implantation of Ocular Prosthesis and other procedures.[10] Additionally, in ophthalmic surgeries performed under general anesthesia, patients have no perception during the operation, and postoperative pain often occurs suddenly, with a high incidence and significant intensity.[11,12] However, due to the aforementioned cognitive biases, their pain needs have long been overlooked, creating a blind spot in postoperative pain management in ophthalmology. Existing research mostly focuses on pain in ophthalmic surgeries under topical or local anesthesia,[13–15] while systematic studies on acute pain after ophthalmic surgeries under general anesthesia are scarce. The incidence, evolution pattern, and influencing factors of such pain remain unclear.

Based on the above background, this study aims to clarify the incidence and dynamic changes of acute postoperative pain in adult patients undergoing general anesthesia for ophthalmic surgery through a prospective cross-sectional survey, and to focus on analyzing the influencing factors of moderate to severe pain, providing evidence-based support for the construction of a stratified and precise postoperative pain management pathway for ophthalmic surgery.

Subjects and Methods

Ethical Approval

This study has been approved by the Biomedical Ethics Committee of West China Hospital of Sichuan University (Approval Number: 2024 Review [532]). Before filling out the online questionnaire, all research participants were fully informed by the researchers in a one-on-one manner about the research purpose, survey content, data confidentiality measures, voluntary participation and withdrawal rights (with no adverse effects after withdrawal), and the corresponding paper-based informed consent form was provided simultaneously. After the participants fully understood the research content and confirmed without any doubts, they voluntarily signed the written informed consent form; after signing, the researchers provided the QR code for the online questionnaire to them and guided them to complete the filling. The entire research process strictly followed the medical research ethics norms and privacy protection requirements. All written informed consent forms were properly archived by the research team in a dedicated cabinet.

Study Design and Subjects

This study employed a cross-sectional survey method. Adult patients who underwent general anesthesia for ophthalmic surgery at the West China Hospital of Sichuan University from November 2024 to May 2025 were selected as the research subjects. The inclusion criteria were as follows: (1) adult patients aged 18 years or older; (2) those who had undergone ophthalmic surgery under general anesthesia; (3) patients with a successful surgery and stable vital signs postoperatively; (4) patients with clear consciousness and the ability to cooperate in pain assessment and questionnaire completion postoperatively; (5) those who provided informed consent and voluntarily participated in the study. The exclusion criteria were as follows: (1) patients with a history of chronic pain (such as long-term headache, neuropathic pain, etc.) or long-term use of analgesic drugs before the operation; (2) patients with a history of mental illness or cognitive or communication disorders, unable to accurately express their pain sensations; (3) patients with other severe organic lesions.

Survey Methods

The survey was carried out via face-to-face interviews and online questionnaires. Each interview lasted around 20 minutes. The interviewers gathered the following data: (1) General information, which included 15 items such as age, gender, educational attainment, marital status, occupation, family type, ethnicity, smoking habits, drinking habits, BMI index, surgical method, surgical level, operation duration, pain level, and the time it took for pain to escalate to moderate to severe levels. (2) Huaxi Emotional-Distress Index (HEI) questionnaire and Athens Insomnia Scale (AIS).

Tools of Survey

Numerical Rating Scale (NRS)

This[16] scale is extensively utilized in pain research both domestically and internationally.[12,17–19] It is frequently applied for the self - assessment of postoperative pain intensity. The scale uses a numerical range from 0 to 10 to denote the pain level. Specifically, 0 represents no pain; 1 to 3 indicates mild pain (where the pain does not interfere with sleep); 4 to 6 indicates moderate pain (slightly affecting sleep); 7 to 9 indicates severe pain (the pain seriously impacts sleep to the extent that one has difficulty falling asleep or wakes up due to pain during sleep); and 10 indicates extreme pain (so intolerable that one is completely unable to calm down).

Huaxi Emotional-Distress Index (HEI) Questionnaire

This scale was developed by the Psychological Health Center of West China Hospital, Sichuan University. At present, it is widely utilized in China for assessing patients' psychological states.[20–22] Specifically, it is employed for screening anxiety and depression among non-psychiatric inpatients. The HEI comprises 9 items and adopts a 5-point rating scale. Here, 0 represents "not at all", 1 represents "occasionally", 2 represents "part of the time", 3 represents "most of the time", and 4 represents "all the time". The total score ranges from 0 to 36. A score of 0–8 points indicates "no negative emotions", 9–12 points indicates "mild negative emotions", 13–16 points indicates "moderate negative emotions", and a score of ≥17 points indicates "severe negative emotions". Domestic research[23,24] reveals that the Cronbach's α coefficient of this scale ranges from 0.89 to 0.917, suggesting that it exhibits good reliability and validity within the Chinese cultural context.

Athens Insomnia Scale (AIS)

This scale is employed to measure the sleep status indicators of patients[25.] It is suitable for screening and determining the severity of insomnia in adults and is extensively utilized in clinical research and practice.[26–28] Comprising 8 items, each item is scored on a 4 - point scale ranging from 0 to 3: 0 (no problem); 1 (slight impact); 2 (moderate impact); 3 (severe impact). The total score spans from 0 to 24. A total score below 4 indicates no insomnia; a score of 4 to 6 suggests suspected insomnia; and a score exceeding 6 indicates the presence of insomnia. Moreover, the higher the score, the more severe the insomnia symptoms. Domestic research reveals[29] that the Cronbach's α coefficient of this scale is 0.90, indicating its good reliability and validity within the Chinese cultural context.

Statistical Analysis

The data were analyzed using PASW Statistics 18. The subjects were classified into two groups according to whether they suffered from moderate to severe pain after surgery: the postoperative moderate-to-severe pain group and the postoperative non-moderate-to-severe pain group. Categorical data were presented in terms of frequency and proportion. The chi-square test or Fisher's exact test was employed for intergroup comparison. A logistic regression model was constructed, with the occurrence of moderate to severe pain after surgery serving as the outcome variable. Stepwise regression was utilized to select independent variables. The test level was set at $\alpha = 0.05$, and a P value < 0.05 was regarded as indicating a statistically significant difference.

Results

General Characteristics of the Subjects

A total of 437 subjects were included in this study, among whom 217 (49.6%) experienced moderate to severe postoperative pain and 199 (45.5%) had mild pain. The average duration of moderate to severe pain was 1.50 hours. The specific details are presented in Table 1.

Table 1 General Characteristics of the Data

Variables	N	%
Pain level		
No pain	21	5%
Mild pain	199	46%
Moderate pain	211	48%
Severe pain	6	1%
Age		
< 60 years old	344	79%
≥ 60 years old	93	21%
Sex		
Male	238	54%
Female	199	46%
Level of education		
Primary school and below	119	27%
Junior high school	146	33%
High school or secondary vocational school	57	13%
Junior college	50	11%
Bachelor's degree or above	65	15%
Marital status		
Unmarried	61	14%
Married	329	75%
Divorced or widowed	47	11%
Occupation		
Employed	100	23%
Unemployed	73	17%
Retired	55	13%
Student	21	5%
Farmer	113	26%
Freelancer	75	17%
Family		
Living alone	16	4%
Living with family	421	96%
Ethnic Group		
Han Chinese	392	90%
Others	45	10%
Smoking		
Yes	103	24%
No	334	76%
Drinking		
Yes	83	19%
No	354	81%

(*Continued*)

Table 1 (Continued).

Variables	N	%
BMI		
<18.5kg/M2	25	6%
18.5–23.9 kg/M2	195	45%
24-27.9 kg/M2	165	38%
≥28 kg/M2	52	12%
Surgical Method		
Others	128	29%
Orbital plastic surgery	66	15%
Orbital tumor resection	154	35%
Enucleation of ocular contents	89	20%
+ Implantation of ocular prosthesis		
Surgical level		
Grade 4 Surgery	124	28%
Below Grade 4 Surgery	313	72%
Surgery duration		
< 1 hour	319	73%
≥ 1 hour	118	27%
HEI Grouping		
No negative emotions	431	99%
Have negative emotions	6	1%
AIS Grouping		
No sleep disorder	223	51%
Suspected insomnia	140	32%
Insomnia	74	17%

Comparison of General Data of Patients with or without Moderate to Severe Pain After Surgery

Statistically significant differences were observed in age, ethnicity, surgical approach, operation time, and AIS score between the two groups, namely those with and without moderate to severe postoperative pain ($P < 0.05$). Conversely, no statistically significant differences were found in gender, educational level, marital status, occupation, family, smoking, drinking, BMI, surgical level, and HEI score between the two groups ($P > 0.05$). For detailed information, please refer to Table 2.

Multivariate Analysis of Moderate to Severe Postoperative Pain

A logistic regression model was constructed to analyze the influence of age, gender, educational level, marital status, occupation, family, ethnicity, smoking, drinking, BMI, surgical method, surgical level, operation time, HEI grouping, and

Table 2 Comparison of General Data of Patients with or without Moderate to Severe Pain After Surgery

Variables	Without Moderate to Severe Pain Group	Moderate to Severe Pain Group	Statistical Methods	Statistical Value	*P* value
Age			Chi-square	5.66	0.0173
< 60 years old	163(47.38%)	181(52.62%)			
≥60 years old	57(61.29%)	36(38.71%)			
Sex			Chi-square	0.00	0.9719
Male	120(50.42%)	118(49.58%)			
Female	100(50.25%)	99(49.75%)			

(*Continued*)

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Table 2 (Continued).

Variables	Without Moderate to Severe Pain Group	Moderate to Severe Pain Group	Statistical Methods	Statistical Value	*P* value
Level of education			Chi-square	0.92	0.9211
Primary school and below	57(47.90%)	62(52.10%)			
Junior high school	77(52.74%)	69(47.26%)			
High school or secondary vocational school	27(47.37%)	30(52.63%)			
Junior college	25(50.00%)	25(50.00%)			
Bachelor's degree or above	34(52.31%)	31(47.69%)			
Marital status			Chi-square	5.84	0.0540
Unmarried	22(36.07%)	39(63.93%)			
Married	174(52.89%)	155(47.11%)			
Divorced or widowed	24(51.06%)	23(48.94%)			
Occupation			Chi-square	7.75	0.1707
Employed	58(58.00%)	42(42.00%)			
Unemployed	33(45.21%)	40(54.79%)			
Retired	32(58.18%)	23(41.82%)			
Student	7(33.33%)	14(66.67%)			
Farmer	52(46.02%)	61(53.98%)			
Freelancer	38(50.67%)	37(49.33%)			
Family			Chi-square	0.29	0.5910
Living alone	7(43.75%)	9(56.25%)			
Living with family	213(50.59%)	208(49.41%)			
Ethnic Group			Chi-square	13.46	0.0002
Han Chinese	209(53.32%)	183(46.68%)			
Others	11(24.44%)	34(75.56%)			
Smoking			Chi-square	1.74	0.1870
Yes	46(44.66%)	57(55.34%)			
No	174(52.10%)	160(47.90%)			
Drinking			Chi-square	0.04	0.8482
Yes	41(49.40%)	42(50.60%)			
No	179(50.56%)	175(49.44%)			
BMI			Chi-square	1.95	0.5823
<18.5kg/M2	11(44.00%)	14(56.00%)			
18.5–23.9 kg/M2	105(53.85%)	90(46.15%)			
24-27.9 kg/M2	80(48.48%)	85(51.52%)			
≥28 kg/M2	24(46.15%)	28(53.85%)			
Surgical Method			Chi-square	51.27	<0.0001
Others	66(51.56%)	62(48.44%)			
Orbital plastic surgery	26(39.39%)	40(60.61%)			
Orbital tumor resection	107(69.48%)	47(30.52%)			
Enucleation of ocular contents+ Implantation of ocular prosthesis	21(23.60%)	68(76.40%)			
Surgical level			Chi-square	0.88	0.3476
Grade 4 Surgery	58(46.77%)	66(53.23%)			
Below Grade 4 Surgery	162(51.76%)	151(48.24%)			
Surgery duration			Chi-square	6.04	0.0140
< 1 hour	172(53.92%)	147(46.08%)			
≥ 1 hour	48(40.68%)	70(59.32%)			
HEI Grouping			Fisher	220.00	1.0000
No negative emotions	220(51.04%)	211(48.96%)			
Have negative emotions	0(0.00%)	6(100.00%)			

(*Continued*)

Table 2 (Continued).

Variables	Without Moderate to Severe Pain Group	Moderate to Severe Pain Group	Statistical Methods	Statistical Value	*P* value
AIS Grouping			Chi-square	109.44	<0.0001
No sleep disorder	166(74.44%)	57(25.56%)			
Suspected insomnia	42(30.00%)	98(70.00%)			
Insomnia	12(16.22%)	62(83.78%)			

Table 3 Multivariate Analysis of Moderate to Severe Postoperative Pain

Variables		OR	SE	Wald Value	DF	*P* value	95% CI	
							Lower Limit	Upper Limit
Age	≥ 60 years old	0.5392	0.2964	4.3439	1	0.0371	0.3016	0.9638
	< 60 years old							
Ethnic Group	Others	2.6980	0.4153	5.7126	1	0.0168	1.1956	6.0884
	Han Chinese							
Surgical Method	Orbital plastic surgery	2.6355	0.3514	7.6057	1	0.0058	1.3236	5.2476
	Enucleation of ocular contents + Implantation of Ocular Prosthesis	4.9202	0.3453	21.2902	1	<0.0001	2.5006	9.6809
	Others	1.7375	0.2852	3.7524	1	0.0527	0.9935	3.0388
	Orbital tumor resection							
AIS Grouping	Suspected insomnia	5.7654	0.2528	48.0106	1	<0.0001	3.5125	9.4632
	Insomnia	12.3098	0.3644	47.4609	1	<0.0001	6.0267	25.1435
	No sleep disorder							

AIS grouping on the incidence of moderate to severe postoperative pain. After controlling for confounding factors, it was discovered that the likelihood of moderate to severe postoperative pain in individuals over 60 years old was 46% lower than that in those under 60 years old (OR = 0.54, 95% CI: 0.30–0.96, $P = 0.0371$). The likelihood of moderate to severe postoperative pain in ethnic minorities was 2.7 times that of Han people (OR = 2.70, 95% CI: 1.20–6.09, $P = 0.0168$). The likelihood of postoperative pain in those who underwent orbital plastic surgery and enucleation of ocular contents+ Implantation of Ocular Prosthesis was 2.64 times (OR = 2.64, 95% CI: 1.32–5.25, $P = 0.0058$) and 4.92 times (OR = 4.92, 95% CI: 2.50–9.68, $P < 0.0001$) that of those who underwent orbital tumor resection, respectively. The likelihood of moderate to severe postoperative pain in individuals with suspected insomnia and insomnia was 5.76 times (OR = 5.76, 95% CI: 3.51–9.46, $P < 0.0001$) and 12.31 times (OR = 12.31, 95% CI: 6.07–25.14, $P < 0.0001$) that of those without sleep disorders, respectively. For more detailed information, please refer to Table 3.

Discussion

The Present Situation of Acute Postoperative Pain in Adult Patients Receiving General Anesthesia in Ophthalmology

Our research findings indicate that the incidence of acute postoperative pain in adult patients undergoing ophthalmic surgery under general anesthesia is 95%. Specifically, the incidence rate of mild pain is 45.5%, and that of moderate to severe pain is 49.6%. Moreover, it takes only 1.50 hours on average for the pain to intensify to moderate to severe levels. This discovery suggests that acute postoperative pain following ophthalmic surgery under general anesthesia is not a "minor and negligible" complication but a common problem that demands significant attention from clinical medical staff.Clinically, although ophthalmic surgeries feature minimally invasive incisions on the body surface, the tissues inside and around the eye are rich in trigeminal nerve branches and are highly sensitive to traction, increased intraocular pressure, and incision stimulation.[30]

Additionally, the duration of ophthalmic surgeries is relatively short, and the blood concentration of analgesic drugs during the recovery period from general anesthesia decreases, leading to a rapid restoration of patients' pain perception. This may result in a concentrated outbreak of early postoperative pain, which is consistent with the finding of "rapid progression to moderate to severe pain within 1.5 hours" in this study. This implies that postoperative analgesic intervention should consider both "timeliness" and "sustainability". Compared with previous studies,[31,32] the incidence of moderate to severe pain in this study was 49.6%, which was higher than the data reported in some literature.[31,32] This might be related to the types of surgeries included in this study. A relatively large proportion of patients in this study underwent orbital plastic surgery, enucleation of ocular contents+ implantation of ocular prosthesis and these surgeries often present more obvious postoperative pain. Meanwhile, during the implementation of this study, to ensure the accuracy of pain assessment and better track the changes in patients' pain, our research team distributed the NRS score sheet to the bedside of patients and adopted a combined self-assessment and other-assessment approach to conduct dynamic pain assessment. This measure might have increased the detection rate and accuracy of pain. Our study initially confirmed the universality of moderate to severe pain after general anesthesia in ophthalmic surgery and negated the traditional belief that "pain after ophthalmic surgery is mild". Notably, our study found that the average time for postoperative pain in adult patients undergoing general anesthesia in ophthalmology to intensify to moderate to severe was only 1.50 hours. This result provides a reference basis for optimizing clinical analgesic regimens. It also suggests that postoperative analgesia for adult patients undergoing general anesthesia in ophthalmology should not be limited to "on-demand administration", but rather a "preventive analgesia" strategy should be adopted.

Analysis of Influencing Factors of Acute Moderate to Severe Pain in Adult Ophthalmic Patients Undergoing General Anesthesia After Surgery

Our research findings indicate that age is a factor influencing the occurrence of acute moderate to severe pain in adult patients undergoing ophthalmic surgery under general anesthesia, which is consistent with the results of studies by Li Yi[33,] Dou Liyuan,[34] and Guimarães,[35] all of which found that younger patients have a higher risk of experiencing pain. Existing research[36] has explained this phenomenon from a physiological perspective: as age increases, the number and sensitivity of pain receptors in the body decrease, and the synthesis of neurotransmitters involved in pain transmission reduces, leading to a decline in the signal transmission function of the nervous system and a decrease in the sensitivity of the pain pathway to stimuli, thereby reducing the patient's perception of pain.

Our research results also show that ethnic differences are an important factor influencing acute moderate to severe pain in adult patients undergoing ophthalmic surgery under general anesthesia. The possibility of experiencing moderate to severe pain after surgery for ethnic minorities is 2.7 times that of Han Chinese. This finding is similar to the conclusions of many domestic and international studies on ethnic/racial differences and postoperative pain. Li Xinping et al's research[37] indicates that the pain threshold of ethnic minority patients such as Uyghurs and Kazakhs is lower than that of Han Chinese, and they are more sensitive to pain; Rahim et al's[38] prospective study also points out that there are significant differences in pain tolerance among different races. The reasons for this may be related to differences in pain sensitivity, analgesic needs, and postoperative pain experiences among different ethnic groups and races. Specifically, cultural background may affect the expression and perception of pain, and the pain tolerance or expression patterns of some ethnic minorities may differ from those of Han Chinese. Additionally, unfamiliarity with the medical environment may increase anxiety, indirectly affecting pain scores. Moreover, language communication barriers or differences in understanding medical procedures may lead to delayed implementation of postoperative analgesic measures, further exacerbating the pain experience. In summary, ethnic factors may influence the perception of postoperative pain in patients through multiple mechanisms, including physiological, psychological, and sociocultural aspects.

The results of this study indicate that the type of surgery is a significant factor influencing acute postoperative pain in ophthalmology. Patients who underwent orbital reconstruction and Enucleation of ocular contents+ Implantation of Ocular Prosthesis had a 2.64 and 4.92 times higher likelihood of experiencing postoperative pain, respectively, compared to those who underwent orbital tumor resection. This finding suggests that different types of ophthalmic surgeries have distinct impacts on postoperative pain, which may be closely related to the degree of surgical trauma, the involved anatomical structures, and the extent of tissue damage. Orbital reconstruction typically involves the repair and

remodeling of eyelids and periorbital soft tissues, and the surgical procedures may cause extensive stimulation to the sensory nerve endings around the eyes. In contrast, enucleation of ocular contents+ Implantation of Ocular Prosthesis is a more invasive procedure that not only involves the removal of the eyeball structure but also the dissection of orbital tissues and the implantation of an orbital implant. Postoperative local inflammatory responses and tissue edema may be more pronounced, thereby inducing more significant pain perception, which is consistent with previous research findings.[39,40] In comparison, orbital tumor resection, although it requires the removal of orbital lesion tissues, has a relatively limited surgical target and causes less disturbance to normal tissues, which may be one of the reasons for its lower postoperative pain incidence.

Our research team has noted that existing studies have mostly focused on the association between more invasive ophthalmic surgeries such as enucleation of ocular contents+ Implantation of Ocular Prosthesis operative pain. However, there is a lack of direct comparative studies on the acute postoperative pain characteristics of orbital reconstruction and orbital tumor resection, two common clinical surgeries, especially regarding the quantified differences in pain risk among different surgical types. This study is the first to confirm through data that the postoperative pain risk of orbital plastic surgery and enucleation of ocular contents+ implantation of ocular prosthesis resection. And all were significantly higher than those of orbital tumor resection.This finding fills the research gap on "the difference in postoperative pain between orbital plastic surgery and orbital tumor resection", and provides direct evidence-based support for pain management in these two types of surgeries in ophthalmic clinical practice.

Our research findings reveal that the likelihood of experiencing moderate to severe postoperative pain among individuals with suspected insomnia and those with insomnia is 5.76 times and 12.31 times higher, respectively, compared to those without sleep disorders. This result highlights a significant association between sleep status and the severity of acute postoperative pain in ophthalmic surgery, which holds significant clinical implications. The analysis of the reasons indicates that the interaction between sleep and pain has been confirmed by multiple studies.[41,42] Sleep disorders can lower the pain threshold of the body and increase pain sensitivity. Conversely, postoperative pain may further deteriorate sleep quality, creating a vicious cycle of "pain-insomnia". Especially for patients with preoperative sleep disorders, they may have higher levels of anxiety and stress, and negative emotions can further enhance the subjective experience of pain. Based on the above and previous research conclusions, we strongly recommend that sleep status be included in the preoperative routine assessment of ophthalmic surgery patients. Early intervention should be provided for those with suspected insomnia or insomnia, and individualized analgesic plans should be formulated to intervene in pain early and avoid the mutual influence between pain and sleep disorders. This may be of great significance in reducing the occurrence of moderate to severe postoperative pain.

Research Limitations

(1) This study adopted a cross-sectional survey design, which can only reflect the postoperative pain status and the association of influencing factors at a single time point. It cannot clarify the causal relationship between variables and is unable to track the dynamic changes of pain over time.

(2) The sample was sourced from a single medical institution, which may be influenced by factors such as regional medical standards and patient characteristics. Therefore, the results cannot be generalized to all patients undergoing general anesthesia.

(3) Not all potential factors that may affect postoperative pain were included, which may have a confounding effect on the comprehensiveness of the results.

(4) Pain assessment relied on patient self-reports, although a standardized scale was used, it may still be affected by subjective factors such as the patient's expression ability and emotional state. Future research could adopt a prospective cohort design, expand the sample source range, and include more potential confounding factors to more accurately reveal the mechanism of postoperative acute pain.

Conclusion

This research carried out a cross-sectional survey involving 437 adult patients who underwent ophthalmic general anesthesia surgeries at West China Hospital of Sichuan University. The survey aimed to uncover the current status and influencing factors

of postoperative acute pain in this patient group. The incidence of postoperative acute pain was found to be high, with nearly half of the cases experiencing moderate to severe pain. The average time for pain to escalate to moderate to severe levels was 1.50 hours. This indicates that the issue of postoperative pain following ophthalmic general anesthesia cannot be overlooked, and early pain intervention measures should be enhanced. Moreover, age, ethnic differences, various types of ophthalmic surgeries, and sleep quality were identified as factors influencing moderate to severe postoperative pain. This implies that ophthalmic medical professionals should pay close attention to these influencing factors. In particular, they should focus on younger patients, ethnic minority patients, those who have undergone more invasive surgical procedures, and individuals with sleep disorders among adult patients who have had ophthalmic general anesthesia surgeries. Tailored pain management strategies should be formulated based on these factors to reduce the incidence of moderate to severe postoperative pain and enhance the postoperative experience of patients.

Abbreviations

NRS, Numerical Rating Scale; HEI,Huaxi Emotional-Distress Index; AIS, Athens Insomnia Scale.

Data Sharing Statement

The datasets generated during the current study are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

The study complied with the Declaration of Helsinki and was approved by the ethics committee of West China Hospital of Sichuan University. All patients provided written informed consent.

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Author Contributions

Xin Zhang is the first author. 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.

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Disclosure

The authors declare that they have no competing interests.

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