

Original Article

Analysis on postoperative agitation of sellar region tumor and observation of effectiveness of nursing risk management

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Abstract: Objective: To investigate the risk factors of agitation in patients after the operation of excising the sellar region tumor, explore effects of postoperative agitation on nursing adverse events as well as observe effectiveness of nursing risk management on precaution of nursing adverse events. Methods: 451 patients who were performed resection of sellar region tumor in our hospital from January, 2013 to June, 2015 were selected as the object. The study was divided into three parts. In the case-control study, patients were divided into the case group and the control group according to occurrence of agitation. Chi-square test and logistic regression analysis with multiple factors were applied to analyze the risk factors of postoperative agitation. In the retrospective cohort study, patients were divided into the exposure group and the control group according to occurrence of agitation. It aimed to observe effects of postoperative agitation on the occurrence of nursing adverse events. In the retrospective survey study, intervention effects of nursing risk management started from March, 2014 on nursing adverse events were observed. Results: 54 patients were observed with postoperative agitation after the operation. Multiple factors analysis indicated that the male, transfrontal operation, postoperative endotracheal intubation were independent risk factors of agitation after the operation of excising the sellar region tumor. The OR respectively were 2.17 (95% CI: 1.36-3.34), 4.81 (95% CI: 2.95-7.67) and 3.11 (95% CI: 2.14-4.96) after being adjusted. In addition, compared with pituitary tumor, the risk of postoperative agitation occurred to patients with craniopharyngioma significantly increased. Compared with the patients in the group without postoperative agitation, the occurrence rate of nursing adverse events in the group of patients with postoperative agitation increased. And the occurrence rate of nursing adverse events was lowered by the nursing risk management. Conclusion: The male, transfrontal operation, areas affected, postoperative endotracheal intubation were all related to the agitation after the operation of excising the sellar region tumor. The postoperative agitation would increase the occurrence of nursing adverse events. Applying the nursing risk management among patients would help reduce the nursing risk and strengthen patients' safety.

Keywords: Nursing adverse events, nursing risk management, sellar region tumor

Introduction

Agitation is common clinical issues of patients who have been performed general anesthesia operation. Its incidence among patients performed intracranial operation is from 2.5% up to 29% [1-4]. It is unclear how the mechanism of postoperative agitation works. Some researchers suggest that the core area of the brain and the ascending reticular activating system remain in the state of suppression during the recovery period of general anesthesia. The postoperative agitation occurs in these patients with the adverse stimulation from external. Preoperative factors including age, sex, genetic predisposition, anxiety and benzodiazepine used before the operation [6-8];

Intraoperative factors including the operative site, anesthesia approach and anesthetics [9], as well as postoperative factors including pains and endotracheal intubation are all related to the increased risk of postoperative agitation as reported [8, 10].

The sellar region tumor accounts for about 15% of brain neoplasm. It is deep in the location and is close to those significant structures covering hypothalamus, the hypothalamus, brain stem, optic nerve, optic chiasm. Therefore, though micro neurosurgery has experienced great development, the occurrence rate of complications like agitation after the operation of the sellar region tumor still remains high. Compared with patients without agitation, patients with

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Table 1. Analysis of possible risk factors and single factor in case group and control group

Patients' characteristics	Cases (n=54)	Control (n=397)	Chi-square/t	p	OR (95% CI)
Gender					
Male	37	183	9.565	0.002	2.55 (1.39-4.67)
Female	17	214			
Age (means ± SD)	56.7±8.4	54.2±7.7	2.21	0.03	1.08 (1.03-1.14)
Smoking history					
Smokers	19	91	3.876	0.049	1.83 (1.00-3.35)
Nonsmokers	35	306			
Neoplasm location					
Pituitary tumors	28	283	16.23	0.001	1
Craniopharyngioma	14	45			
Meningiomas	7	38			
Others	2	34			
Pre hospital stay	6.3±2.5	5.6±2.3	2.076	0.94	1.04 (1.01-1.06)
Anesthesia time					
≥3.7 h	36	225	6.907	0.007	1
<3.7 h	18	208			
Approaches					
Transfrontal	38	136	26.162	0.000	4.56 (2.45-8.47)
Transsphenoidal	16	261			
Postoperative endotracheal intubation					
Presence	24	71	20.168	0.000	3.67 (2.03-6.67)
Absence	30	326			
Postoperative pain					
Presence	34	189	4.484	0.034	1.87 (1.04-3.36)
Absence	20	208			

agitation are more likely to come up with nursing adverse events, such as unplanned extubation (UEX) or detachment, fall and skin injury [8, 11]. And hospitalization cost is probable to increase [12]. Therefore, investigating the risk factors of agitation on patients after the operation of excising the sellar region tumor is of great significance to the precaution of postoperative agitation and the reduction of corresponding adverse results.

The risk management is a management process, which is used to identify, evaluate and manage the existent and latent medical risks so that occurrences and damages as well as economic losses of patients and hospitals can be decreased. It's a process to identify, evaluate and take corrective actions about the latent risks. In other words, it is a detective, observable and interventional process toward those risks. Our hospital has started implementing

the nursing risk management for patients performed resection of sellar region tumor operations since Mar, 2014. In this paper, 451 patients who performed resection of sellar region tumor operations in our hospital from Jan, 2013 to Jun, 2015 were followed up. In addition, we analyzed the risk factors about the relevant post-operative agitation, and assessed effects of the nursing risk management on preventing the nursing adverse events caused by post-operative agitations.

Materials and methods

Object of study

Our research was authorized by the Hospital's Ethics Committee. The object of study was 451 patients who were performed resection of sellar region tumor operations in our hospital from Jan, 2013 to Jun, 2015. The inclusion criteria: Being diagnosed with sellar region tumor, being performed general anesthesia operations to remove tumors under sellar region, having no other serious illness, informed consent. The exclusion criteria: Having other severe or deteriorating illnesses, having serious pre-operative cognition deficit or mental disorder, having definite post-operative history of agitation.

Analysis of post-operative agitation

Riker sedation agitation scoring system (SAS) was adopted [13] to score patients' consciousness and post-operative degrees of agitation 1 to 7 on their different actions after the operations. Scoring 1 to 4 means no agitation, but 5 to 7 means that there are some existent agita-

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Table 2. Multiple factors analysis and logistic regression analysis on risk factors of agitation of patients in sellar region tumor operation

Patients' characteristics	OR*	95% CI	P
Gender			
Male	1		0.01
Female	2.17	1.36-3.34	
Neoplasm location			
Pituitary tumors	1		
Craniopharyngioma	3.45	1.67-5.24	0.005
Meningiomas	1.29	0.63-2.19	0.21
Others	0.72	0.45-1.13	0.17
Approaches			
Transfrontal	1		0.002
Transsphenoidal	4.81	2.95-7.67	
Postoperative endotracheal intubation			
Presence	1		0.001
Absence	3.11	2.14-4.96	

*Note: Adjustments of age, smoking, anesthesia time and chief complaints of postoperative pain.

Table 3. Comparison of nursing adverse events of patients in sellar region tumor operation

Nursing adverse events	Agitation (n=54)	No agitation (n=397)	P*
Unplanned Extubation (UEX)			
Catheter	7 (13.0%)	0 (0)	<0.001
Indwelling needle	20 (37.0%)	17 (4.3%)	<0.001
Electrocardiogram	6 (11.1%)	2 (0.5%)	<0.001
Fall	8 (14.8%)	24 (6.0%)	0.041
Skin injury	9 (16.7%)	25 (6.3%)	0.013

*Note: Exact test was used.

tions, which should receive corresponding clinical treatments.

Research design

Research on the risk factors of post-operative agitation

Collect information of patient's demographics data, namely gender and age, smoking history, tumor site, hospital stay before operation, surgical procedure, anesthesia duration and conditions about endotracheal intubation and chief complaints of pain before post-operative agitation. The patients were divided into case group and control group, based on the occurrence of post-operative agitation. Analyzing risk factors of post-operative agitation was made for patients who were performed sellar region

tumor operation through case-control study.

Research on effects of post-operative agitation of nursing adverse event

Analyze the probability that whether the post-operative agitation would increase the occurrence rate of nursing adverse events or not, comparing with patients' occurrences of post-operative agitation, including unplanned extubation (removals of tracheal intubation), gastric canal, urethral catheter, drainage tube, indwelling needle and electrocardiogram, fall and skin injury during clinical nursing.

Research on effects of nursing risk management

Our hospital has started implementing the nursing risk management in neurosurgery wards since Mar, 2014. This management makes risk assessment by using the nursing risk identification, systematic and continual identification and analysis of the existent and latent nursing risk, improves the management mechanism and defines the roles in the nursing risk management. Reserved plan has been made according to patients' preliminary nursing risk identification. Once in risk, patients would have pertinent remedial measures so as to avoid any danger and reduce damages. Evaluate its effectiveness on the basis of how it went on

handling nursing adverse events before and after adopting nursing risk management, as well as patients' satisfaction.

Statistical analysis

The significant test was carried out on patients who showed agitation or not. Their sex, smoking history, location, anesthesia time, operation method, postoperative endotracheal intubation, chief complaints of postoperative pain, nursing adverse time and other categorical variables were analyzed by using bilateral χ^2 test or Fisher exact test. Continuous variable means like age and preoperative hospitalization time were compared by two-sample independent t test. Bilateral $\alpha=0.05$ was considered as significant standard. Independent risk factors for postoperative agitation were ana-

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Table 4. Comparison of occurrence of nursing adverse events before and after risk management

Events	Cases	UEX			Fall	Skin Injury
		Cathe- ter	Indwelling needle	Electrocard- iogram		
	216	7 (3.2)	26 (12.0)	7 (3.2)	24 (11.1)	24 (11.1)
	235	0 (0)	11 (4.7)	1 (0.4)	8 (3.4)	10 (4.3)
P		0.005	0.004	0.031*	0.001	0.006

*Note: Exact test was used.

lyzed by univariate and multivariate conditional logistic regression. Among the multivariate analysis, likelihood ratio test was based on the maximum partial likelihood and independent variables were chosen step by step.

Results

Basic information

451 patients of sellar region tumor included 220 male cases and 231 female cases. The average age was 54.9 years old. The main tumor types were pituitary tumors (311 cases, 69%), craniopharyngioma (59 cases, 13.1%), meningiomas (45 cases, 10%) and other tumors (36 cases, 8%). Postoperative agitation occurred in 54 cases. Listing the basic information of patients with and without postoperative agitation, **Table 1** showed that compared with those without postoperative agitation, patients having postoperative agitation were mostly male; Besides, the preoperative hospitalization time, smoking history, endotracheal intubation after volume operation, chief complains of postoperative pain accounted for larger proportion. However, there is no significant difference in preoperative hospitalization time between two groups (see **Table 1**).

Independent risk factors of postoperative agitation

As **Table 1** indicated, sex, ages, smoking, location of tumor, operation method, anesthesia time, postoperative endotracheal intubation and chief complains of postoperative pain were the potential risk factors of patients, who performed resection of sellar region tumor. These above factors were analyzed by logistic regression and demonstrated that male, operation method and postoperative endotracheal intubation were independent risk factors leading to postoperative agitation. The adjusted OR were 2.17 (95% CI: 1.36-3.34), 4.81 (95% CI: 2.95-

7.67) and 3.11 (95% CI: 2.14-4.96). What's more, patients with craniopharyngioma, in comparison, took a remarkable higher risk of postoperative agitation than those with pituitary tumor (OR=3.45, 95% CI: 1.67-5.24). Nevertheless, there was no significant increase among patients with meningioma. (As show in **Table 2**).

Comparison of nursing adverse events happened to patients with and without postoperative agitation

In 54 cases of postoperative agitation, there were 7 cases of unplanned extubation of gastric canal, grainage tube, endotracheal intubation and urethral catheter (13.0%). But there was 0 case of unplanned extubation happened to patients without postoperative agitation. The occurrence rates of two groups' unplanned extubation of indwelling needle and electrocardiogram were 37% and 11.11% vs. 4.3% and 0.5%. Differences of two groups have statistical significance. Besides, the occurrence rates of fall and skin injury of patients with postoperative agitation were higher than patients without it (see **Table 3**).

Nursing risk management and effectiveness evaluation

After the implementation of nursing risk management (March 2014), the occurrence of adverse events in the previous routine nursing care were compared. The occurrence rates of adverse events before and after the implementation of nursing risk management were shown in **Table 4**. After the implementation of nursing risk management, the incidences of fall, skin injury and unplanned extubation such as catheter, indwelling needle, electrocardiogram and so on were significantly lower than that of routine nursing.

Discussion

Although the occurrence rate of agitation after intracranial operation has been reported, there is still a lack of reports about large sample research of patients with sellar region tumor. In a research of our country, among 606 cases of patients with sellar region tumor resection,

9.08% appeared agitation after operation [14]. Another study reported that 13 cases of psychiatric symptoms and altered mental status occurred in the 163 cases of patients with sellar region tumor operation [15]. In this study, the occurrence rate of agitation after the operation in patients with sellar region tumor resection was 12.0%. The results were similar to the aforesaid two studies.

This study demonstrated that male and postoperative endotracheal intubation were independent risk factors of postoperative agitation in patients with sellar region tumor resection. This found was similar to the results of some other studies [4, 6, 9, 11]. However, there were other studies indicating that male was not the risk factor of postoperative agitation [16]. The association between gender and postoperative agitation requires further studies to confirm. Lu and other researchers suggested the duration of anesthesia of patients with intracranial operation also increased the risk postoperative agitation [4], but in this study, such relationship had no statistical difference in multivariate analysis. Our results were similar to those of L. Munk [11], nevertheless, latter object of study was not confined to neurosurgery patients. Besides, in the study of Lu, it considered the interaction of anesthesia methods and anesthesia time. And Lu studied effects of different anesthetics on agitation [17, 18]. This study did not involve the above research content. The association between postoperative pain and agitation was inconsistent. The research which was carried out in non-neurosurgery patients found that the pain was an important risk factor of postoperative agitation [6, 9], while in the research of intracranial operation patients had no such connection [4]. On the one hand, the reason for inconsistency probably was the different way of pain assessment, such as VAS score and NRS score. On the other hand, disturbance of consciousness that aroused by intracranial operation may also influence the accuracy of VAS score and NRS score [19, 20].

In this study, the location of the tumor and the methods of operation were associated with the occurrence risk of postoperative agitation. Compared with pituitary tumor, craniopharyngioma significantly increased the occurrence risk of postoperative agitation. The reason for the low incidence of postoperative agitation of pituitary tumor might be that the growth position of pituitary tumor was in the sellar region.

And it was separated from brain tissue by sellar which meant it could be easily separated from surrounding tissues. Sellar region meningiomas generally have a complete sarachnoid interface with surrounding tissues and important vessels. The surgical principle is to separate along the interface, thus causing less damage. Although the craniopharyngioma is benign, it is always connected with some important physiological structures such as optic nerve, pituitary stalk, the hypothalamus, etc. In the process of surgery, the hypothalamus was always involved, so it can easily cause damage to temporal lobe which contributes to arousing postoperative agitation. There were researches finding that the operation through the forehead could remarkably increase the concurrence risk of postoperative agitation of intracranial operation. This might have connections with the function of anterior lobe as well as cognitive and affective behavior. Intracranial operation through the forehead may lead to abnormal behavior changes [4, 21].

Our study found that the occurrence rate of nursing adverse events of patients who were performed resection of sellar region tumor with agitation was markedly higher than those without agitation, including unplanned extubation, fall and skin injury, which was similar to the results in other studies [4, 8, 22]. To improve the quality of nursing care and decrease the occurrence of nursing adverse events, nursing risk management was implemented in our department in January 2014. Nursing risk management is based on the method and the principle of risk management, through the process of identifying and the assessing nursing risks, and then exploring the scientific preventive measures and remedies in order to ensure the security of patients and reduce the risks of patients, health care workers and medical institutions. Its primary coverage includes identification, analysis, assessment, management, continuous monitoring, communication and counseling [23]. The implementation of nursing risk management produced a significant reduction in the occurrence rate of nursing adverse events, like unplanned extubation and fall of patients performed resection of sellar region tumor, with a greater increase of satisfaction degree of patients compared with the conventional nursing. Several studies have shown that risk management, as an essential measure to decrease the medical treatment adverse

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events and to increase the patients security, needs to be designed in accordance with different clinical issues accordingly [24, 25]. In the study, we analyzed risk factors of postoperative agitation which could provide reference for the development of nursing risk management.

Several limitations in the study deserve to be mentioned such as no consideration of anesthetics and methods selection. The previous research considered inhalation anesthesia as an independent risk factor to postoperative agitation while using total intravenous anesthesia could decrease occurrence rate of those risks [4, 8]. And the increased risk of post-operation agitation is more likely to appear by using sevoflurane and isoflurane than propofol during surgery [18, 26]. In this study, intravenous-inhalation combined general anesthesia in all patients nearly makes little difference to the conclusion on account of their similar anesthetics and anesthetic method. Besides, the assessment in nursing risk management requires a natural observation before and after the implementation, but not adopting controlled clinical trial after randomization probably with the confounding bias, which may impact on the reliability of result.

To sum up, in our study, we found that agitation after sellar region tumor removal has correlations with these risk factors like gender, approach, disease location and postoperative endotracheal intubation. And nursing risk management can play a preventive effect on nursing adverse events of which the occurrence rate rises with increasing agitation. To risk identification, prevention, and reduction of postoperative agitation, these findings are informative.

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Disclosure of conflict of interest

None.

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References

- [1] Todd MM, Warner DS, Sokoll MD, Maktabi MA, Hindman BJ, Scamman FL and Kirschner J. A prospective, comparative trial of three anesthetics for elective supratentorial craniotomy. Propofol/fentanyl, isoflurane/nitrous oxide, and fentanyl/nitrous oxide. *Anesthesiology* 1993; 78: 1005-1020.
- [2] Kanaya N, Kuroda H, Nakayama M, Homma Y and Namiki A. Does propofol anesthesia increase agitation in neurosurgical patients?-a pilot study. *Can J Anaesth* 2002; 49: 638-639.
- [3] Kleinknecht RA and Thorndike RM. The mutilation questionnaire as a predictor of blood/injury fear and fainting. *Behav Res Ther* 1990; 28: 429-437.
- [4] Chen L, Xu M, Li GY, Cai WX and Zhou JX. Incidence, risk factors and consequences of emergence agitation in adult patients after elective craniotomy for brain tumor: a prospective cohort study. *PLoS One* 2014; 9: e114239.
- [5] Aouad MT and Nasr VG. Emergence agitation in children: an update. *Curr Opin Anaesthesiol* 2005; 18: 614-619.
- [6] Radtke FM, Franck M, Hagemann L, Seeling M, Wernecke KD and Spies CD. Risk factors for inadequate emergence after anesthesia: emergence delirium and hypoactive emergence. *Minerva Anesthesiol* 2010; 76: 394-403.
- [7] Zhang SQ, Wang G, Yu W, Zhan H and Chen HW. Relationship between apolipoprotein e4 allele and emergence agitation in patients undergoing general anesthesia. *Nan Fang Yi Ke Da Xue Xue Bao* 2008; 28: 1652-1653.
- [8] Lepouse C, Lautner CA, Liu L, Gomis P and Leon A. Emergence delirium in adults in the post-anaesthesia care unit. *Br J Anaesth* 2006; 96: 747-753.
- [9] Yu D, Chai W, Sun X and Yao L. Emergence agitation in adults: risk factors in 2,000 patients. *Can J Anaesth* 2010; 57: 843-848.
- [10] Kim HC, Kim E, Jeon YT, Hwang JW, Lim YJ, Seo JH and Park HP. Postanaesthetic emergence agitation in adult patients after general anaesthesia for urological surgery. *J Int Med Res* 2015; 43: 226-235.
- [11] Munk L, Andersen G and Moller AM. Post-anaesthetic emergence delirium in adults: incidence, predictors and consequences. *Acta Anaesthesiol Scand* 2016; 60: 1059-1066.
- [12] Hudek K. Emergence delirium: a nursing perspective. *AORN J* 2009; 89: 509-516; quiz 517-509.

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- [13] Riker RR, Picard JT and Fraser GL. Prospective evaluation of the sedation-agitation scale for adult critically ill patients. *Crit Care Med* 1999; 27: 1325-1329.
- [14] Brusselaers N, Pirayesh A, Hoeksema H, Verbelen J, Blot S and Monstrey S. Burn scar assessment: a systematic review of objective scar assessment tools. *Burns* 2010; 36: 1157-1164.
- [15] Huang SH, Wu SH, Lee SS, Chang KP, Chai CY, Yeh JL, Lin SD, Kwan AL, David Wang HM and Lai CS. fat grafting in burn scar alleviates neuropathic pain via anti-inflammation effect in scar and spinal cord. *PLoS One* 2015; 10: e0137563.
- [16] Xara D, Silva A, Mendonca J and Abelha F. Inadequate emergence after anesthesia: emergence delirium and hypoactive emergence in the postanesthesia care unit. *J Clin Anesth* 2013; 25: 439-446.
- [17] Liang C, Ding M, Du F, Cang J and Xue Z. Sevoflurane/propofol coadministration provides better recovery than sevoflurane in combined general/epidural anesthesia: a randomized clinical trial. *J Anesth* 2014; 28: 721-726.
- [18] Liu GY, Chen ZQ and Zhang ZW. Comparative study of emergence agitation between isoflurane and propofol anesthesia in adults after closed reduction of distal radius fracture. *Genet Mol Res* 2014; 13: 9285-9291.
- [19] Suraseranivongse S, Yuvapoositanont P, Srisakkrapikoo P, Pommul R, Phaka W and Itthimathin P. A comparison of pain scales in patients with disorders of consciousness following craniotomy. *J Med Assoc Thai* 2015; 98: 684-692.
- [20] Nair S and Rajshekhar V. Evaluation of pain following supratentorial craniotomy. *Br J Neurosurg* 2011; 25: 100-103.
- [21] Potegal M. Temporal and frontal lobe initiation and regulation of the top-down escalation of anger and aggression. *Behav Brain Res* 2012; 231: 386-395.
- [22] Cho YS and Yeo JH. Risk factors for deliberate self-extubation. *J Korean Acad Nurs* 2014; 44: 573-580.
- [23] Su LJ, Yu KH. Application of nursing risk management in obstetrical nursing management and evaluation on its effect. *Chinese Nursing Research* 2013; 27: 3553-3554.
- [24] Neale G, Woloshynowych M and Vincent C. Exploring the causes of adverse events in NHS hospital practice. *J R Soc Med* 2001; 94: 322-330.
- [25] Adibi H, Khalesi N, Ravaghi H, Jafari M and Jeddian AR. Development of an effective risk management system in a teaching hospital. *J Diabetes Metab Disord* 2012; 11: 15.
- [26] Kim YS, Chae YK, Choi YS, Min JH, Ahn SW, Yoon JW, Lee SE and Lee YK. A comparative study of emergence agitation between sevoflurane and propofol anesthesia in adults after closed reduction of nasal bone fracture. *Korean J Anesthesiol* 2012; 63: 48-53.