Risk Factors Analysis of Post Anesthesia Induction Hypotension in Patients with Recurrent Nasopharyngeal Carcinoma

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Abstract: This study is to investigate the risk factors of post anesthesia induction(PIH) in patients with recurrent nasopharyngeal carcinoma. A retrospective analysis was conducted on the clinical data of 262 patients who underwent the nasal endoscopic surgery from January 2021 to May 2023 were into this study. These patients were divided into group A(patients of non-PIH) and group B(patients of PIH). Univariate analysis and multivariate Logistic regression analysis were performed to analyze the independent risk factors of PIH. The overall incidence rate of PIH was 17.56%. According to the univariate analyses, anesthetics used for induction (dexmetomidine) and Preoperative serum sodium level were significantly correlated with PIH in patients with recurrent nasopharyngeal carcinoma($p<0.05$). Furthermore, multivariate logistic regression prediction model identified the two indicators above are independent risk factors for PIH in patients. The model fit well, and the area under the receiver operating characteristic curve was 0.676, and the predictive sensitivity and specificity were 78% and 53.2%, respectively. The results of this paper show that, anesthetics used for induction (dexmetomidine) and Preoperative serum sodium level were independent risk factors for PIH. It provides theoretical foundation for predicting PIH after splenectomy.

Keywords: Recurrent Nasopharyngeal Carcinoma; Nasal Endoscopic Surgery; Post-induction Hypotension

1. Introduction

Hypotension is a common perioperative adverse event. A Meta analysis showed that perioperative hypotension was significantly associated with acute renal injury, myocardial injury and 30-day mortality in patients undergoing non-cardiac surgery. Hypotension after anesthesia induction (post-induction hypotension, PIH) refers to the hypotension that occurs from the beginning of anesthesia induction to skin incision, accounting for about 1/3 of the total perioperative hypotension. Hypotension during operation is the result of blood loss, operation, anesthetic and other factors, which is relatively complex. In contrast, PIH is mainly caused by the patient's own state and anesthetic management, has nothing to do with the surgical process, and is preventable to a certain extent. However, at present, the research on PIH is mostly focused on the impact of postoperative complications and mortality, and the research on related risk factors is relatively few. In this paper, the authors retrospectively analyzed the risk factors of PIH in patients with recurrent nasopharyngeal carcinoma under general anesthesia in our hospital, in order to provide reference for the prevention and timely treatment of high-risk patients with PIH, so as to improve the safety of anesthesia.

2. Materials and Methods

2.1 Subject

This study was approved by the hospital Ethics Committee(KY2023-574-01). Patients undergoing endoscopic nasal resection under elective general anesthesia in our hospital from January 2020 to May 2023 were collected. Exclusion criteria:Severe cardiovascular and cerebrovascular diseases; severe liver kidney and lung function Injury; age less than 18 years; enter operating room basic systolic blood pressure is less than 90 mmHg or greater than or equal to 160 mmHg; incomplete data.

2.2 Data Collection

The following data were recorded: age, gender and body mass index (BMI), comorbidity diseases (hypertension, diabetes, radiotherapy

frequency, nasal endoscopic surgery), ASA physical statu, surgical classification, anaesthetics used for induction(midazolam, esketamine, dexmetomidine), preoperative experimental findings(albumin, hemoglobin, serum calcium, serum sodium, serum potassium, red blood cell distribution width).

2.3 Statistical analysis

SPSS23.0 statistical software was used for data processing and analysis. Measurement data was expressed as mean ± standard deviation or madian(quartile). Count data was presented as the number of cases (n) and percentage (%). The t test and chi-square test was performed to analyze the differences between PIH group and non-PIH group. Multivariate logistic regression analysis was conducted among multiple factors. Logistic regression prediction model was established and Logit P value was calculated. Receiver operating characteristic curve (ROC curve) was generated.

Table 1. Comparison of Clinical Features Between PIH Group and Non-PIH Group

Clinical features	Non-PIH（n=200）	PIH（n=62）	P-value
Age(year)			
<65	180（90%）	56（90.3%）	0.941
>=65	20（10%）	6（9.7%）	
Gender			
Male	148（74.0%）	43（69.4%）	0.472
Female	52（26.0%）	19（30.6%）	
Hypertension	27（13.5%）	12（19.4%）	0.258
Diabetes	13（6.5%）	3（4.8%）	0.633
Radiotherapy frequency			0.425
1	155（77.5%）	51（82.3%）	
2	45（22.5%）	11（17.7%）	
Nasal endoscopic surgery	52（26.0%）	20（32.3%）	0.335
ASA			0.221
Degree I	8（4.0%）	4（6.5%）	
Degree II	157（78.5%）	42（67.7%）	
Degree III~IV	35（17.5%）	16（25.8%）	
Surgical classification			0.709
Degree I	52（26.0%）	14（22.6%）	
Degree II	56（28.0%）	15（24.2%）	
Degree III	53（26.5%）	21（33.9%）	
Degree IV	39（19.5%）	12（19.4%）	
Midazolam	174（87.0%）	56（90.3%）	0.485
Esketamine	38（19.0%）	6（9.7%）	0.086
Dexmetomidine	114（57.0%）	48（77.4%）	0.004
Albumin（g/L）	36.61±3.61	35.64±3.49	0.062
Hemoglobin（×109/L）	113.33±20.31	108.27±18.30	0.081
Serum calcium（mmol/L）	2.24±0.11	2.25±0.09	0.507
Serum sodium（mmol/L）Serum	137.88±3.39	136.56±3.70	0.009
potassium（mmol/L）	3.87±0.35	3.88±0.42	0.878
Red blood cell distribution width（%）	0.14（0.03）	0.14（0.03）	0.807

3. Results

3.1 Univariate Analysis

A retrospective analysis was conducted on the clinical data of 262 patients who underwent the nasal endoscopic surgery from January 2021 to May 2023 were into this study. These patients were divided into group A(patients of non-PIH) and group B(patients of PIH). There were 62 cases in the PIH group and 200 cases in the non-PIH group, The overall incidence rate of

PIH was 17.56%. According to the univariate analyses , anesthetics used for induction (dexmetomidine) and Preoperative serum sodium level were significantly correlated with PIH in patients with recurrent nasopharyngeal carcinoma($p<0.05$). The results of univariate analysis are shown in Table 1.

3.2 Multivariate Logistic Regression Analysis

We put those variables （ $p<0.1$ ） that were confirmed to be significant in the univariate analysis into the multivariate logistic regression model. First, stepwise regression (forward-LR) was used to further screen the regressors. Multivariate logistic regression analysis showed that the use of dexmedetomidine during induction and preoperative serum sodium value were independent risk factors for hypotension in patients with recurrent nasopharyngeal carcinoma undergoing endoscopic sinus surgery ($P < 0.05$). Based on the results of multivariate Logistic regression analysis, the logistic regression prediction model was established.The bigger Logit P value was, the higher the risk for PVT was. The specific results of multivariate Logistic regression analysis are shown in Table 2.

3.3 Receiver operating characteristic curve

The regression model was tested by Hosmer-Lemeshow. The results showed that the model fit was good and the difference was not statistically significant ($\chi2=15.088$, $P=0.057$). The prediction sensitivity of the model was 78.0% and the specificity was 53.2%. The AUROC was 0.676, indicating that this model has certain predictive value for PIH in patients with recurrent nasopharyngeal carcinoma undergoing endoscopic surgery. see Figure 1.

4. Discussion

After the theory of “enhanced recovery after surgery” was proposed, precise anesthesia management has become more and more important. Stable circulation management is an important part of precise anesthesia management. Many studies have shown that PIH is a predictor of postoperative complications and poor outcomes. Therefore, early identification of high-risk groups of PIH and active prevention and treatment measures are conducive to promoting the rapid recovery of patients.

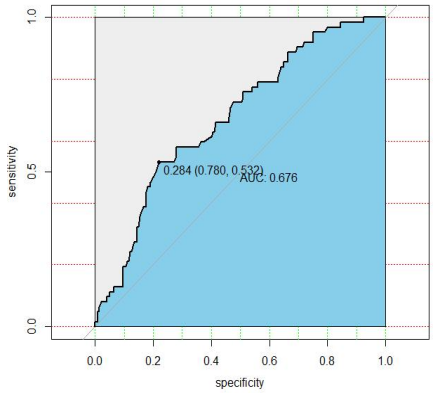

Figure 1. Receiver Operating Characteristic Curve of Logistic Regression Model

Dexmedetomidine is a widely used anesthetic adjuvant drug in clinical practice. It has good sedative, analgesic, and inhibitory effects on sympathetic nerve excitation. It also has the characteristics of reducing myocardial oxygen consumption, passivating sympathetic response during surgery and improving cardiac prognosis. The cause of adverse reactions may be that dexmedetomidine activates α 2 adrenergic receptors, leading to hypotension. It also produces dose-dependent bradycardia, reduces sympathetic tone, baroreceptor reflex, and enhances vagal nerve activity, further increasing the risk of hypotension. Preoperative serum sodium level is recognized as an important factor affecting PIH among clinicians, and a large number of literatures have confirmed that preoperative serum sodium level is an excellent indicator for predicting perioperative blood transfusion. Low serum sodium levels may lead to a decrease in plasma colloid osmotic pressure and reflexive reduction in renin-angiotensin release, resulting in increased urine output, which further leads to decreased blood volume and an increased risk of hypotension. The results of this paper also shows that, anesthetics used for induction (dexmetomidine) and Preoperative serum sodium level were independent risk factors for PIH. It provides theoretical foundation for predicting PIH after splenectomy.

Table 2. Multivariate Logistic Regression Analysis

Variables	Regression coefficient (β value)	Standard error (SE)	Wald value	OR	95% confidence interval (CI)	P
dexmetomidine	1.057	0.346	9.354	2.878	1.462~5.667	0.002
serum sodium（mmol/L）	-0.118	0.042	7.938	0.889	0.819~0.965	0.005

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