

CHINESE MEDICAL SCIENCES JOURNAL

ORIGINAL ARTICLE

Evaluation of Risk Factors for Arytenoid Dislocation after Endotracheal Intubation: a Retrospective Case-control Study

Le Shen¹, Wu-tao Wang², Xue-rong Yu¹, Xiu-hua Zhang^{1*},
and Yu-guang Huang^{1*}

¹Department of Anesthesiology, Peking Union Medical College Hospital, Chinese Academy of Medical Sciences & Peking Union Medical College, Beijing 100730, China

²Department of Anesthesiology, Affiliated Hospital of Xi'an Medical University, Xi'an 710077, China

Key words: arytenoid dislocation; complication; endotracheal intubation

Objective To investigate the risk factors for postoperative arytenoid dislocation.

Methods From September 2003 to August 2013, the records of 16 patients with a history of postoperative arytenoid dislocation were reviewed. Patients matched in terms of date and type of procedures were chosen as the controls ($n=16$). Recorded data for all patients were demographics, smoking status, alcoholic status, preoperative physical status, airway evaluation, intubation procedures, preoperative laboratory test results, anesthetic consumption and intensive care unit stay. For arytenoid dislocation cases, we further analyzed the incidences of the left and right arytenoid dislocation, and the outcomes of surgical repair and conservative treatment. Categorical variables were presented as frequencies and percentages, and were compared using the chi-squared test. Continuous variables were expressed as means $\pm$ SD and compared using the Student's unpaired t -test. To determine the predictors of arytenoid dislocation, a logistic regression model was used for multivariate analysis.

Results Sixteen patients with postoperative arytenoid dislocation were enrolled, with a median age of 52 years. Most postoperative arytenoid dislocation patients (15/16, 93.75%) received surgical repair, except one patient who recovered after conservative treatment. None of the postoperative arytenoid dislocation patients were smokers. Red blood cell ($P=0.044$) and hemoglobin ($P=0.031$) levels were significantly lower among arytenoid dislocation cases compared with the controls.

Conclusions Non-smoking and anemic patients may be susceptible to postoperative arytenoid dislocation. However, neither of them was independent risk factor for postoperative arytenoid dislocation.

Chin Med Sci J 2014; 29(4):221-224

ARYTENOID dislocation is a rare clinical complication after endotracheal intubation.¹ Common symptoms of this condition include hoarseness, breathy voice, and dysphagia.² The causes include the use of laryngeal mask airway.³ The incidence of this complication is estimated to be 0.1%,⁴ yet there is no systematic study on the incidence. In addition, few studies have showed any definite or possible risk factors associated with arytenoid dislocation. To identify the potential risk factors associated with postoperative arytenoid dislocation. We conducted this retrospective matched case-control study, taking into account possible variables, such as patients' demographic characteristics, preoperative conditions, anesthesia and surgical procedures, aiming to identify possible risk factors for postoperative arytenoid dislocation.

PATIENTS AND METHODS

Patients and data collection

The protocol was approved by the institutional human investigation committee of Peking Union Medical College Hospital (PUMCH). From September 2003 to August 2013, altogether sixteen cases of postoperative arytenoid dislocation were reported in PUMCH. For each case of postoperative arytenoid dislocation, one patient matched in date and type of anesthetic and surgical procedures was chosen as the control. Medical records of all the patients and controls were reviewed.

All the patients of both groups were monitored with electrocardiography, non-invasive arterial pressure, pulse oximetry, and capnography in operating room. Recorded data of all the patients were compared, including demographics, smoking and drinking status, preoperative physical status, airway evaluation, intubation procedures, preoperative laboratory test results, anesthetic use and intensive care unit (ICU) stay. For arytenoid dislocation

cases, we further analyzed the proportions of left and right arytenoid dislocation, and the outcomes of surgical repair and conservative treatment. All the arytenoid dislocation cases were examined and diagnosed by vocal cord specialists using video laryngo-stroboscopy.

Statistical analysis

Statistical analyses were performed with SPSS version 19.0 (SPSS Inc., Chicago, IL, USA). Categorical variables were presented as frequencies and percentages, and were compared using the Chi-squared test. Continuous variables were expressed as means $\pm$ SD and compared using the Student's unpaired *t*-test. To determine the predictors of arytenoid dislocation, a logistic regression model was used for multivariate analysis. All reported *P*-values were two-sided, and *P*<0.05 was considered to indicate statistical significance.

RESULTS

Sixteen patients demonstrating postoperative arytenoid dislocation (eight women and eight men) were included, with a mean age of 52 $\pm$ 20 years. The arytenoid dislocations cases and the controls were matched in the demographic indexes, except for the smoking status. None of the postoperative arytenoid dislocation cases were smokers, in comparison to the existence of five smokers in the control group (*P*=0.017, Table 1). Ten patients (62.50%) had left arytenoid dislocation and six (37.50%) had right arytenoid dislocation (Table 2). Most postoperative arytenoid dislocation patients (15/16, 93.75%) received surgical repair, except one who recovered after conservative treatment (Table 2). Meanwhile, most postoperative arytenoid dislocation cases were reported in the years from 2011 to 2013 (13/16, 81.25%, Fig. 1).

Table 1. Demographics of arytenoid dislocation cases *versus* matched controls (both *n*=16)

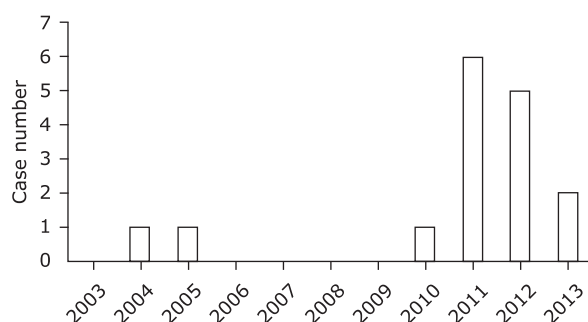
Groups	Age ($\bar{x} \pm s$, years)	Gender (M:F)	Height ($\bar{x} \pm s$, cm)	Body weight ($\bar{x} \pm s$, kg)	BMI ($\bar{x} \pm s$, kg/m ²)	Smoking status [<i>n</i> (%)]	
						Smoker	Non-smoker
Matched controls	58.63± 9.01	10:6	167.75±6.40	69.00±12.93	24.38±3.51	5 (31.25)	11 (38.75)
Arytenoid dislocation	51.69±19.84	8:8	164.75±7.21	61.34±11.84	22.53±3.65	0	16 (100.00)
<i>P</i>	0.217	0.483	0.223	0.091	0.155	0.017	
Groups	Drinking status [<i>n</i> (%)]		ASA grade [<i>n</i> (%)]		NYHA grade [<i>n</i> (%)]		
	Drinker	Non-drinker	I-II	III-IV	I	II	III
Matched controls	2 (12.50)	14 (87.50)	12 (75.00)	4 (25.00)	7 (43.75)	9 (56.25)	0
Arytenoid dislocation	1 (6.25)	15 (93.75)	12 (75.00)	4 (25.00)	13 (81.25)	1 (6.25)	2 (12.50)
<i>P</i>	0.551		1		0.084		

BMI: body mass index; ASA: American Society of Anesthesiologists; NYHA: New York Heart Association.

Table 2. Surgical and anesthesia procedures of arytenoid dislocation cases *versus* matched controls [both $n=16$, n (%)]

Groups	Surgical procedure				Mallampatti score		Times of intubation		
	Abdominal/ general surgery	Neurosurgery	Orthopedics surgery	Cardiovascular surgery	I-II	III-IV	Once	≥2 times	
Matched controls	11 (68.75)	1 (6.25)	1 (6.25)	3 (18.75)	16 (100.00)	0	15 (93.75)	1 (6.25)	
Arytenoid dislocation	11 (68.75)	1 (6.25)	1 (6.25)	3 (18.75)	15 (93.75)	1 (6.25)	13 (81.25)	3 (18.75)	
<i>P</i>	1		0.317		0.293				
Groups	Intubation stylet		Postoperative ICU stay		Arytenoid dislocation side			Treatment	
	With	Without	Yes	No	Left	Right	Both	Surgical repair	Conservative treatment
Matched controls	8 (50.00)	8 (50.00)	5 (31.25)	11 (68.75)	/	/	/	/	/
Arytenoid dislocation	11 (68.75)	5 (31.25)	5 (31.25)	11 (68.75)	10 (62.50)	6 (37.50)	0	15 (93.75)	1 (6.25)
<i>P</i>	0.288		1		/			/	

ICU: intensive care unit.

**Figure 1.** Arytenoid dislocation cases reported from 2003 to 2013.

Of the laboratory test results, red blood cell ($P=0.044$) and hemoglobin ($P=0.031$) levels were significantly lower in arytenoid dislocation cases than in matched controls (Table 3). However, logistic regression analysis showed that neither non-smoking ($P=0.999$) nor low red blood cell/hemoglobin level ($P=0.053$) was an independent risk factor for postoperative arytenoid dislocation. Neither intubation procedure nor ICU stay had influence on the incidence of postoperative arytenoid dislocation.

DISCUSSION

The average number of patients who received general anesthesia with intubation at PUMCH was 20 000 to 25 000 per year. We found that arytenoid dislocation occurred at a very low rate, less than 0.01%, in patients receiving tracheal intubation over the past 10 years in our hospital. The incidence of postoperative arytenoid dislocation in our study population is similar to another retrospective survey¹ which found 4 cases of this complication in 13 698 intubation cases (0.029%) over a 3-year period, but extremely lower than another previous report that found one arytenoid cartilage dislocation in 1000 direct laryngoscopic intubations.⁴ We routinely chose the tracheal tube with internal diameter of 7.5 mm for men and that with internal diameter of 7.0 mm for women, and the use of tubes with smaller diameters may reduce the risk of arytenoid dislocation after anesthesia.⁵

Our data showed that smokers' proportion, red blood cell count and hemoglobin levels were significant lower in

Table 3. Laboratory test results of arytenoid dislocation cases *versus* matched controls (both $n=16$, $\bar{x} \pm s$)

Groups	RBC count ($\times 10^{12}/L$)	WBC count ($\times 10^9/L$)	Hemoglobin (g/L)	Platelet ($\times 10^9/L$)	Albumin (g/L)	ALT (U/L)	PT (s)	APTT (s)
Matched controls	4.30±0.51	7.41±2.41	129.44±14.71	232.50±78.36	37.63±5.93	28.88±25.55	12.22±1.56	28.63± 8.77
Arytenoid dislocation	3.80±0.76	8.17±3.11	114.38±22.27	217.00±90.52	35.69±4.99	18.71±10.34	13.66±4.58	32.82±13.96
<i>P</i>	0.044	0.447	0.031	0.608	0.325	0.176	0.244	0.317

RBC: red blood cell; WBC: white blood cell; ALT: alanine aminotransferase; PT: prothrombin time; APTT: activated partial thromboplastin time.

the arytenoid dislocation group than in the control group. Smoking always induces chronic cough, expectoration and pharyngitis,⁶ which might cause chronic inflammatory infiltration and stabilize arytenoid joint. In contrast, anemia might result in unstable or fragile arytenoid joint that is susceptible to dislocation. Our results also suggest that body weight ($P=0.091$) and New York Heart Association grade ($P=0.084$) might be factors associated with the occurrence of postoperative arytenoid dislocation, which means slimmer but stronger patients might be more susceptible. However, no statistical significance was found between the arytenoid dislocation group and the control group in terms of these two factors.

Most postoperative arytenoid dislocation cases in this study were reported from the year 2011 to 2013, a fact presumably attributed to two reasons. Firstly, since 2011 several types of video-assisted laryngoscopes have been applied for intubation in our hospital. These techniques could improve the view of vocal cord significantly, and thereby facilitating the procedure of intubation. Secondly, the adverse event reporting system was implemented in our hospital in the year 2010. From then on, postoperative arytenoid dislocation, on the list of adverse events, must be reported to both the Department of Anesthesiology and the Department of Medical Affairs, assuring that no case of postoperative arytenoid dislocation was missed. The reporting system raised the attention to postoperative arytenoid dislocation in anesthesiologists, and increased the officially reported incidence of this complication as a by-effect.

This study has some limitations. Patients enrolment was dependent on the medical records, primarily the discharge diagnosis of all the medical records in the past 10 years. However, not all the patients complicated with postoperative arytenoid dislocation were diagnosed before discharge, which might partially explain the low incidence of arytenoid dislocation in this study. A larger prospective study is necessary to define more precisely the incidence of this complication. The second limitation is the nature of this study being a retrospective case-control study. There is most likely some degree of selection bias, and the sample size is only 16 in either group. These limitations reduced

the effectiveness of statistical analysis. Risk factors such as ICU stay⁷ and intubation times⁸ that previously reported as associated with postoperative hoarseness and arytenoid dislocation showed no statistical significance in this study. A multicenter study with enrolment from more hospitals may lead to more reliable results.

In conclusion, the incidence of postoperative arytenoid dislocation was lower than 0.01% in patients receiving endotracheal intubation in this study. Non-smoking and anemic patients might be susceptible to postoperative arytenoid dislocation; however, neither of the factors was an independent risk factor for postoperative arytenoid dislocation.

REFERENCES

1. Szigeti CL, Baeuerle JJ, Mongan PD. Arytenoid dislocation with lighted stylet intubation: case report and retrospective review. *Anesth Analg* 1994; 78: 185-6.
2. Rubin AD, Hawkshaw MJ, Moyer CA, et al. Arytenoid cartilage dislocation: a 20-year experience. *J Voice* 2005; 19: 687-701.
3. Rosenberg MK, Rontal E, Rontal M, et al. Arytenoid cartilage dislocation caused by a laryngeal mask airway treated with chemical splinting. *Anesth Analg* 1996; 83: 1335-6.
4. Yamanaka H, Hayashi Y, Watanabe Y, et al. Prolonged hoarseness and arytenoid cartilage dislocation after tracheal intubation. *Br J Anaesth* 2009; 103: 452-5.
5. Mikuni I, Suzuki A, Takahata O, et al. Arytenoid cartilage dislocation caused by a double-lumen endobronchial tube. *Br J Anaesth* 2006; 96: 136-8.
6. Rigotti NA. Smoking cessation in patients with respiratory disease: existing treatments and future directions. *Lancet Respir Med* 2013; 1: 241-50.
7. Niwa Y, Nakae A, Ogawa M, et al. Arytenoid dislocation after cardiac surgery. *Acta Anaesthesiol Scand* 2007; 51: 1397-400.
8. Tan V, Seevanayagam S. Arytenoid subluxation after a difficult intubation treated successfully with voice therapy. *Anaesth Intensive Care* 2009; 37: 843-6.