

Research Article

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Clinical Study of the Incidence of Arytenoid Cartilage Dislocation for the Patients after General Anesthesia with Tracheal Intubation

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Abstract

Incidence of arytenoid cartilage dislocation for patients treated or examined under general anesthesia with tracheal intubation in one hospital had not been reported. And true incidence and mechanism of arytenoid cartilage dislocation after tracheal intubation are not investigated yet. Here, we examined retrospectively the incidence of arytenoid cartilage dislocation for patients after general anesthesia with tracheal intubation in the Central Surgical Center of Nippon Medical School Main Hospital for two years from 2004 until 2005. The incidence of arytenoid cartilage dislocation for patients after general anesthesia with tracheal intubation was 0.2%, and patients received cardiovascular surgeries were the most common. The mean age of the patients with arytenoid cartilage dislocation was 70 years. It could be considered that additional medical instrumentation of the esophagus including transesophageal echocardiography probe or upper gastrointestinal endoscopy, and prolonged tracheal intubation for more than two days should be the risk factors causing arytenoid cartilage dislocation. And calcification of the laryngeal cartilage and morphological changes of the cervical vertebrae along with aging might also contribute to dislocate the arytenoid cartilage.

Keywords: Arytenoid cartilage dislocation; Tracheal intubation; General anesthesia; Incidence

Introduction

It had been recognized that the arytenoid cartilage dislocation may be caused by medical instrumentation used with the larynx and esophagus, and external neck trauma such as whiplash injury [1-3]. Medical instrumentation such as endotracheal intubation, laryngeal airway mask intubation [3], upper gastrointestinal endoscopy [4] and transesophageal echocardiography probe [5] may be responsible for complications. Difficult endotracheal intubation, over-zealous use of lighted stylet for the tracheal intubation, traumatic insertion of laryngoscope blade, prolonged endotracheal intubation, or extubation with a partially deflated cuff were reported as the causes of arytenoid cartilage dislocation [6,7]. A case with the arytenoid cartilage dislocation after severe violent cough [8], and an idiopathic arytenoid cartilage dislocation [9] were also reported. Currently, the endotracheal intubation is considered to be the most common cause of arytenoid cartilage dislocation [1-3]. The patients with arytenoid cartilage dislocation often complain of hoarseness, aphonia, misdeglutition, and odynophagia. These symptoms may cause significant distress on patients and clinicians, which may even lead to a medical-legal dispute. The incidence of arytenoid cartilage dislocation after endotracheal intubation has not been well reported. Additionally, other potential factors which may contribute to the complication during the endotracheal intubation have never been studied. This is a retrospective study to analyze the incidence and clinical features of arytenoid cartilage dislocation after general anesthesia with endotracheal intubation in the Central Surgical Center of Nippon Medical School Main Hospital.

Subjects and Method

Subjects

The subjects consist of all patients who had general endotracheal anesthesia for all indicated procedures at the Central Surgical Center of Nippon Medical School Main Hospital from January 2004 until

December 2005 (Table 1). Patients with suspected arytenoid cartilage dislocation previously consulted with laryngologists at the same institution. Their symptoms consisted of unusually severe breathy

Fields of treatments	Total number of patients	Incidence of arytenoid
Gastrointestinal surgery	1809	2
Orthopedics	1670	0
Otorhinolaryngology, head and neck surgery	1309	0
Obstetrics and gynecology	967	0
Maxillo-facial and reconstructive surgery	760	0
Cardiovascular surgery	667	12
Neurosurgery	660	1
Urology and adrenal gland surgery	559	0
Ophthalmology	361	0
Respiratory surgery	362	3
Breast surgery	196	0
Others	374	2
Total number	9694	20

Table 1: The list of total patients treated or examined under general anesthesia with tracheal intubation and the incidence of patients with arytenoid cartilage dislocation in the Central Surgical Center of Nippon Medical School Main Hospital for two years from 2004 to 2005.

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hoarseness, misdeglutition, or aphonia postoperatively for more than three days. All patients received laryngological examinations within 7 days after the incidence of symptoms related to arytenoid cartilage dislocation. Each patient was classified by sex, age, height, side of dislocation of the arytenoid cartilage (anterior or posterior), pre-existing medical conditions, surgical procedures performed, additional medical instrumentation during surgery, difficulty with intubation, endotracheal tube size (external diameter) in relation to height, and inserted length of the tracheal tube from the incisor teeth in relation to height.

Diagnostic protocol for arytenoid cartilage dislocation

The diagnosis of the arytenoid cartilage dislocation was made by the use of a video-laryngeal fibroscope, palpation of the cricoarytenoid joint, and fluorography of the larynx on repetitive phonation of the glottal fricative sound/he/ [10,11]. In some cases, a sagittal CT imaging at the level of the posterior cricoarytenoid ligament and electromyographic examination about the intrinsic laryngeal muscle were used [1,11]. The following video-laryngeal fibroscopic observation was used to determine the direction of dislocation. For anteriorly dislocated patients, the vocal fold was flaccid and became even more flaccid during the phonation with abnormal medial projection of the vocal process. For posteriorly dislocated patients, the vocal fold was prolonged tensely and made more movement during phonation. Palpating the cricoarytenoid joint showed abnormal swelling with tenderness for patients with posteriorly dislocated arytenoid cartilage. The video-fluorography of the larynx on repetitive phonation of the glottal fricative sound/he/ showed an abnormally high and diagonal displacement of the vocal fold on the dislocated side on the upper structure of the arytenoid cartilage. Any evidence of trauma, such as submucosal hemorrhage, edema, granulomatous tissue formation, ulceration, or scar tissue around the vocal process of the arytenoid cartilage was noted using a fibroscope.

Results

The mean age of the study group was 52 years, ranging from birth to 97 years. There were 4818 females (49.7%) and 4876 male (50.3%) patients. 20 patients were diagnosed with arytenoid cartilage dislocation in this study (The incidence of arytenoid cartilage dislocation was 0.2%) (Table 2). The mean age of patients with arytenoid cartilage dislocation was 70 years, ranging from 45 to 84 years old. There were 7 females (35%) and 13 males (65%). The mean age of female patients was 71 years, and the mean age of male patients was 64 years. There were 14 cases of anterior dislocation (70%) and 6 of posterior dislocation (30%). There were 15 left-sided dislocations (75%) and 5 right-sided dislocations (25%). In the group with anterior dislocation, there were 3 females and 11 males, and 11 left sided dislocations and 3 right-sided dislocations. In the group of posterior dislocation, there were 5 females and 1 male, and 4 left-sided dislocations and 2 right-sided dislocations. The most common surgery associated with the complication was cardiovascular surgery (12 patients, 60%) (Tables 1 and 2). And the incidence of arytenoid cartilage dislocation after the cardiovascular surgeries was significantly greater than the incidence related to other surgeries ($P < 0.05$). The arytenoid cartilage dislocation was observed in patients who had additional intraoperative instrumentations of the esophagus with transesophageal echocardiography probe (9 patients, 45%) and upper gastrointestinal endoscopy (1 patient, 5%). In this group of patients, there were 8 anterior dislocations and 2 posterior dislocations. There was only one patient with arytenoid dislocation after a particularly difficult intubation (Table 3). The timing of extubation was investigated. 6 patients was immediately extubated after the surgery, 9 patients were extubated on the next day, and 5 patients were extubated more than five days after the surgery (Table 3). In the group of prolonged entotracheal intubation more than two days after the surgery, there were 9 anterior dislocations and 5 posterior dislocations. There were only two patients (patient 14, 15) in the group without an

Patient number	Age	Sex	Type of dislocation	Disturbed side	Disease for surgery	Surgical procedure	additional medical instrumentations
1	56	Male	Anterior	Left	Angina pectoris	CABG	TEE
2	58	Male	Anterior	Left	Stenosis of mitral valve	TMV	TEE
3	63	Male	Anterior	Left	Angina pectoris	CABG	TEE
4	65	Female	Posterior	Left	Angina pectoris	CABG	TEE
5	67	Female	Posterior	Left	Combined valvular disease of the heart	TCV	TEE
6	68	Male	Anterior	Left	Angina pectoris	CABG	TEE
7	73	Female	Anterior	Left	Angina pectoris	CABG	None
8	73	Male	Anterior	Right	Angina pectoris	CABG	None
9	76	Female	Anterior	Left	Angina pectoris	CABG	TEE
10	77	Male	Anterior	Right	Angina pectoris	CABG	TEE
11	81	Male	Anterior	Left	Angina pectoris	CABG	None
12	84	Female	Anterior	Right	Angina pectoris	CABG	TEE
13	56	Male	Anterior	Left	Stomach cancer	OG	UGE
14	60	Male	Anterior	Left	Lung cancer	OP	None
15	69	Female	Posterior	Right	Lung cancer	OP	None
16	77	Male	Anterior	Left	Pulmonary bulla with intestinal pneumonia	TB	None
17	58	Male	Anterior	Left	Hanging, hypoxic encephalitis	?	None
18	45	Male	Posterior	Left	Perforation of the intestine	OI	None
19	54	Female	Posterior	Left	Fulminant hepatitis	?	None
20	78	Female	Posterior	Right	Subarachnoid hemorrhage	CC	None

CABG, coronary arterial bypass grafting; CC, craniotomy and clipping; OG, open gastrectomy; OI, open surgery for intestinal perforation; OP, open pneumonectomy; TB, thoracoscopic bullectomy; TCV, thoracotomy combined valves surgery; TEE, transesophageal echocardiography; TMV, thoracotomy mitral valve surgery; UGE, upper gastrointestinal endoscopy

Table 2: The list of the incidence of arytenoid cartilage dislocation after the general anesthesia with tracheal intubation.

Patient number	Height of patient (cm)	Insertion of tracheal tube	Time of extubation	External diameter of the tracheal tube (mm)	Length from the incisor teeth (cm)
1	162	Easy	Next day	10.2	21
2	163	Easy	Next day	10.9	23
3	151	Easy	Next day	11.3	28
4	146	Easy	Next day	9.6	21
5	164	Easy	Next day	10.9	21
6	166	Easy	Just after the surgery	10.9	23
7	160	Easy	Next day	10.3	21
8	163	Easy	Next day	11.3	23
9	141	Easy	Just after the surgery	10.9	20.5
10	168	Easy	Just after the surgery	10.9	23
11	143	Easy	5 days after	10.3	21
12	137	Easy	Next day	9.6	18
13	162	Easy	Just after the surgery	12.2	22
14	162	Easy	Just after the surgery	9.6	22
15	148	Easy	Just after the surgery	10.3	24
16	?	Easy	10 days after	10.9	23
17	?	Difficult	5 days after	12.2	22
18	170	Easy	Next day	10.9	22
19	158	Easy	3 weeks after	10.3	22
20	150	Easy	3 weeks after	10.3	18

Table 3: The conditions of tracheal intubation for the patients with arytenoid cartilage dislocation.

episode of additional medical instrumentations of the esophagus or prolonged tracheal intubation. The sizes of endotracheal tubing used based on the height of the patients were appropriate for all patients with the complication (except patients 16, 17 who had no record of their heights) (Table 3). Also, distance of the endotracheal tube from the tip of the tracheal tube to incisor teeth seemed to be appropriate to have the cuff below the vocal folds, based on the height of each patient with the complication (except patients 16, 17 who had no record of their height) (Table 3). There was no patient with arytenoid cartilage dislocation with an evidence of mucosal injury around the vocal process of the arytenoid cartilage in this study.

Discussion

The cricoarytenoid joint is an arthrodial joint supported by a capsule lined with synovium, and attached with posterior cricoarytenoid ligament [1-3]. The intrinsic laryngeal muscles which are attached to the arytenoid cartilages contribute to the movement and position of the arytenoid cartilage. The larynx is supported by the mandible via the hyoid bone with the connection of the suprahyoid muscles, thyrohyoid muscles, and the pharyngeal muscles in front of the cervical spine. Under general anesthesia with the use of muscle relaxants, excessive pressure during intubation may dislocate arytenoid cartilage anteriorly. If traumatic intubation causes anterior arytenoid dislocation, mucosal injury or submucosal hemorrhage is expected to be seen for at least 2 weeks after the incidence. Similarly, if posterior dislocation of the arytenoid cartilage is caused by traumatic insertion of an endotracheal tube, formations of granulomatous tissue, ulcerative lesion or scar tissue around the vocal process of the arytenoid cartilage is expected to be present. However, in many reports, no direct evidence of trauma is usually present, except only the presence of arytenoid cartilage dislocation. In this study, no evidence of traumatic intubation leading to arytenoid cartilage dislocation was noted. The endotracheal tube sizes and the distance from the tip of the tracheal tube to the incisor teeth of all the patients with arytenoid cartilage dislocation were appropriate for the height of each patient. Based on these findings, intubation trauma alone does not appear to cause dislocation of arytenoid cartilage, but

other accompanying conditions with endotracheal intubation may be responsible for the arytenoid cartilage dislocation.

In this study, the overall incidence of arytenoid cartilage dislocation after general anesthesia with endotracheal intubation in this hospital was 0.2%. The reported incidence rate of arytenoid cartilage dislocation varies from 0.023% [7] to 6.2% [12]. In this study, there were 7 females (35%) and 13 males (65%). The mean age of female patients was 71 years, and the mean age of male patients was 64 years. And there were 14 anterior dislocations (70%) and 6 posterior dislocations (30%). Rubin et al. [3] reported that the number of female patients is greater than the number of male patients, and the mean age of the patients was 42.5 years, and the incidence of posterior dislocation was significantly greater than the incidence of anterior dislocation. The differences between the result of this study and the results reported by Rubin et al. [3] may be due to the differences in the timing of the initial diagnosis of arytenoid cartilage dislocation. In Rubin's study, initial diagnosis was made after longer intervals up to 36 years, whereas in this study, the diagnosis was made within 7 days of the incidence. His study was also conducted among many hospitals.

There were 10 patients with the arytenoids cartilage dislocations who had additional medical instrumentation during the intubation, including transesophageal echocardiography and upper gastrointestinal endoscopy (50%). 14 patients with the complication had prolonged endotracheal intubation (70%) in this study. It could be considered that a patient who is having cardiovascular surgery is more prone to complications due to the increased chance of medical instrumentation being implemented during surgery and/or prolonged post-operative intubation. There were only two patients (patient 14, 15) who suffered complications without any evidence of medical instrumentation around the trachea/esophagus or prolonged intubation (10%).

In this study, there was no evidence of mucosal trauma caused by additional medical instrumentation around the esophagus which may have contributed to arytenoid cartilage dislocation. Therefore, additional medical instrumentations of the esophagus with endotracheal intubation may not directly cause the arytenoid cartilage

dislocation. Additional conditions should be considered for the cause of arytenoid cartilage dislocation. During general anesthesia with the use of muscle relaxants, the intrinsic laryngeal muscles as supporting muscles to position the arytenoid cartilage is paralyzed and flaccid, which may make the cartilage more vulnerable to postero-lateral pressure caused by the endotracheal intubation. Additional antero-medial pressure on the cartilage caused by medical instrumentation of the esophagus may further contribute to the dislocation. These elements within a given period of time might cause gradual dislocation of the arytenoid cartilage. In this study, the mean age of the patients with arytenoid cartilage dislocation was 70 years. Thus, the calcification of the laryngeal cartilages with aging, excessively anteriorly bending of the cervical vertebrae with aging, and bony spikes or excessive calcification of the anterior longitudinal ligament of the cervical vertebrae with aging, especially for male patients, may create more anteriorly directed pressure to the arytenoid cartilage. Further clinical analysis should be warranted to investigate the “true” mechanism and incidence of arytenoid cartilage dislocation.

References

1. Hoffman HT, Brunberg JA, Winter P, Sullivan MJ, Kileny PR (1991) Arytenoid subluxation: diagnosis and treatment. *Ann Otol Rhinol Laryngol* 100: 1-9.
2. Sataloff RT, Bough ID Jr, Spiegel JR (1994) Arytenoid dislocation: diagnosis and treatment. *Laryngoscope* 104: 1353-1361.
3. Rubin AD, Hawkshaw MJ, Moyer CA, Dean CM, Sataloff RT (2005) Arytenoid cartilage dislocation: a 20-year experience. *J Voice* 19: 687-701.
4. Kakushima N, Hotta K, Tanaka M, Kawata N, Sawai H, et al. (2012) Anterior arytenoid cartilage dislocation, a rare complication of esophagogastroduodenoscopy. *Endoscopy* 44: E363.
5. Niwa Y, Nakae A, Ogawa M, Takashina M, Hagiwara S, et al. (2007) Arytenoid dislocation after cardiac surgery. *Acta Anaesthesiol Scand* 51: 1397-1400.
6. Prasertwanitch Y, Schwarz JJ, Vandam LD (1974) Arytenoid cartilage dislocation following prolonged endotracheal intubation. *Anesthesiology* 41: 516-517.
7. Szigeti CL, Baeuerle JJ, Mongan PD (1994) Arytenoid dislocation with lighted stylet intubation: case report and retrospective review. *Anesth Analg* 78: 185-186.
8. Nerurkar N, Chhapola S (2012) Arytenoid subluxation after a bout of coughing: a rare case. *Am J Otolaryngol* 33: 275-278.
9. Saigusa H, Nonaka Y, Ikezono T, Aino I, Iwasaki C, et al. (2005) [Spontaneous dislocation of the arytenoid cartilage]. *Nihon Jibiinkoka Gakkai Kaiho* 108: 164-167.
10. Saigusa H, Tanuma K, Nakamura T, Aino I, Kokawa T, et al. (2003) The exact diagnosis of arytenoid cartilage dislocation: morphological and clinical studies. *J Jpn Bronchoesophagol Soc* 54: 401-415.
11. Saigusa H, Kokawa T, Aino I, Iwasaki C, Nakamura T, et al. (2003) Arytenoid dislocation: a new diagnostic and treatment approach. *J Nippon Med Sch* 70: 382-383.
12. Kambic V, Radsel Z (1978) Intubation lesions of the larynx. *Br J Anaesth* 50: 587-590.