# **Brief Communication**

# Postoperative Reintubation at Postanesthesia Care Unit from 2010 to 2011 at a Teaching Hospital in Taiwan

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**Objectives:** Reintubation in the postanesthesia care unit is associated with serious complications in anesthesia. We want to know the reintubation rate and risk factors at our hospital.

**Methods:** Reintubation has been defined as repeated endotracheal intubating in the postanesthesia care unit after the planned extubation of the initial intubation for general anesthesia. The reintubation cases were retrospectively extracted from the Quality Assurance database of our institution from 2010 to 2011, which were analyzed using descriptive statistics.

**Results:** Of all the 39,931 cases of anesthesia at our institution within the study period, 19,233 were performed under general anesthesia with endotracheal intubation in which reintubation was required in 13 (reintubation rate 0.068%). The risk factors for reintubation included an age over 70, American Society of Anesthesiologists (ASA) Physical Status 3 (ASA III), head-neck surgery, and burr hole operation. Hemodynamic instability in the postanesthesia care unit due to sepsis or internal bleeding also played a role in reintubation. Moreover, respiratory failure was more likely within 40 minutes after extubation. Additionally, the time period from 3:00 p.m. to 5:00 p.m., which is the most chaotic time in the operating theater, is also related to extubation failure in the present study.

**Conclusions:** The results of our research could help us identify the full range of causes and provide appropriate strategies to prevent the incidence of reintubation.

**Key words:** reintubation, postoperative, postanesthesia, postanesthesia care unit (PACU), postoperative recovery room (POR)

# Introduction

Reintubation in the postanesthesia care unit (PACU) after extubation following

general anesthesia implies associations with life-threatening, serious complications. Early reports of the incidence of reintubation in the PACU range from 0.17% to 0.45%.<sup>1-3</sup> Ting et al. reported an incidence of 0.06% for post-

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operative reintubation after planned extubation in 2010<sup>4</sup> and that patients with preoperative chronic obstructive pulmonary disease (COPD), pneumonia, ascites, and systemic inflammatory response syndrome were more likely to require reintubation. A retrospective study at the University of Michigan in 2003 concluded that respiratory problems were the most common causes of reintubation.5 A multicenter study in Thailand in 2005 stated that the three main precipitating factors were the residual effects of neuromuscular blocking and anesthetic agents, upper airway obstruction, and unstable hemodynamics.6 However, the studies of reintubation in PACU are still rare, probably because the risk factors for reintubation are complicated and vary with individual hospitals. In this study, we aimed at analyzing the reintubation rate and specific risk factors of our hospital through which we could implement appropriate strategies for reducing the incidence of reintubation.

# **Materials and Methods**

In this article, reintubation was defined as repeated endotracheal intubation in the PACU after the planned extubation as opposed to that performed in the operating room. Patients receiving general anesthesia with the use of laryngeal mask airway (LMA) were excluded from our survey. The patients who were reintubated in PACU from January 1, 2010 to December 31, 2011 were retrospectively and consecutively sorted from the Quality Assurance database of the Department of Anesthesiology, E-Da hospital, which is a teaching hospital of Taiwan with more than 1200 beds. The results of reintubation rate and risk factors were analyzed as descriptive statistics.

# Results

Of all the 39,931 cases of anesthesia at our hospital from 2010 to 2011, 19,233 consecutive

patients underwent endotracheal intubation for general anesthesia of whom 13 (0.068%) required reintubation in our PACU.

Of the 13 patients, seven were over 70 years old, seven were men and six were women, 11 (85%) were classified as ASA III and two (15%) as ASA II. Regarding surgery and medication, three patients involved neck compression due to head-neck surgery and two were diagnosed as having subdural hemorrhage (SDH) receiving burr hole operation, while morphine overdose induced at PACU was identified as the cause in one patient. In terms of clinical presentations, three patients experienced a blood pressure drop due to sepsis or bleeding and one patient suffered from a seizure. As regards the timing of reintubation, 10 patients (77%) required the procedure within forty minutes after arriving in the PACU or being extubated in PACU. Close to half of the patients (47%, n = 6) were reintubated between 3:00 p.m. and 5:00 p.m. Concerning the outcomes, two patients were sent to the wards and eleven required advanced care in the ICU where one was discharged against advice and one expired. The data are presented in Table 1.

# Discussion

In this article, we focused on reintubations in the PACU with the exclusion of those in the operating room. Although our reintubation rate was nearly the same as that reported in a previous study by Ting et al. in which 78.3% of the events were in the operating room and 21.7% occurred in the PACU,<sup>4</sup> our study focused only on cases in the PACU. In addition, we excluded general anesthesia performed with the use of the laryngeal mask airway (LMA) instead of the endotracheal tube in our survey. In recent years, LMA has gained much popularity at our hospital (13,194 cases in 2 years) to decrease the use of anesthetics and muscle relaxants

No	Age	Gende	er Specialty	Procedure	ASA	Arrival F	Txtubation	Time after	Head-neck	Resniratory	Unstable	Other	Outcome
	(years	(F/M) (F/M)				in i PACU	n PACU	arrival in PACU or extubation in PACU (min)	surgery	event causes	hemodynamics	underlying diseases	
_	59	ы	CS	Intra-thoracic goiter	e S	12:35		80	Bleeding, neck compression			H/T, DM	Ward/discharge
7	78	М	NS	Burr hole	ŝ	16:30		40	4	Seizure, SDH		HCV	ICU/discharge
$\mathfrak{c}$	77	Μ	GU+ Proc	: URSM+ colostomy	б	14:02		23			BP↓	H/T	ICU/discharge
4	88	Ц	Proc	Colon obstruction	$\mathfrak{c}$	11:26 1	13:30	20		Delay awake, 88 years		H/T	ICU/discharge
5	41	М	Ortho	Left, humeral fracture	З	16:30		20		Hemothorax		Chest trauma	ICU/discharge
9	59	Ц	GU	Bladder cancer	З	17:47		37		ESRD		ESRD	ICU/discharge
٢	58	Ц	Proc	Sigmoid colon cancer	5	15:36		14			Int. bleeding, BP (	H/T	ICU/discharge
~	71	Μ	GS	Left inguinal hernia	$\mathfrak{c}$	15:51		19		Hypoventilation, Liver chirrosis		H/T, DM, CAD	Ward/discharge
6	74	Ц	Ortho	Right TKR, revision	7	12:44		131		Morphine 6+5 mg COPD		H/T	ICU/discharge
10	72	Ц	NS	Chronic SDH; Right side	$\mathfrak{S}$	16:43		0		SDH		Pre-op GCS: E3V4M5	ICU/discharge
11	44	Μ	ENT	Left oropharyngeal cancer (soft palate)	$\mathfrak{c}$	15:08 1	16:20	30	Neck compression	п		Alcoholism	ICU/discharge
12	73	Μ	GS	Small intestine lymphoma	$\mathfrak{c}$	20:24		76			Sepsis, BP 🔱	DM	ICU/AAD
13	41	М	PS	Neck skin defect in advanced oral cancer	3	13:03		5	Neck compressior morphine 5 mg	η,		DM, HBV	ICU/expired
Note PAC C vii	: The d U: Post us; IC	lata are anesthe U: Inter	from the Q sia, postane nsive care u	uality Assurance Databa sthesia care unit; CS: Ch nit; GU+Proc: Genitour.	se of t lest su inary+	the Depar Irgery; H/ +proctosu	tment of <i>i</i> 'T: Hypert∉ rgery; UR	Anesthesiolc ansion; DM: SM+: Uretu	vgy, E-Da Hospital : Diabetes mellitus rorenoscopic stone	, from 2010 to 201 ; NS: Neurosurger ; manupilation; BP	<ol> <li>ASA: Americ</li> <li>SDH: Subdur</li> <li>Blood pressur</li> </ol>	can society of ral hemorrhage re; Proc: Proct	anesthesiologists; ;; HCV: Hepatitis osurgery; Ortho:

pulmonary disease; GCS: Glasgow coma scale; ENT: Ear nose throat; AAD: Against advise discharge; PS: Plastic surgery; HBV: Hepatitis B virus

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during operations. Only one patient with pulmonary edema and severe metabolic acidosis required intubation in the PACU after the removal of an LMA (0.008%). Therefore, large scale use of LMA could influence the incidence of reintubation.

Concerning the influence of the choice of anesthetics on reintubation, volatile anesthetics with low blood/gas coefficient (desflurane and sevoflurane) and muscle relaxants with intermediate half-life (rocuronium and cisatracurium) have been popularly used at our hospital. The scenario is different from that of the Thai study in which the residual effect of neuromuscular blocking and anesthetic agents was found to be the main factor prompting reintubation (53%-57% of the reintubation incidents).<sup>6</sup> By contrast, in the Michigan study, the incidence of reintubation due to prolonged neuromuscular block was low (5.8% of the reintubation incidents) and occurred predominantly in cases where pancuronium and vecuronium were used (9 out of 11 cases).<sup>5</sup> However, since these two drugs are virtually no longer in use at our hospital, our incidence of reintubation resulting from the residual effects of muscle relaxants was relatively low compared with that of the two previous studies.5,6

In this study, patients receiving two types of surgery appeared to be particularly at risk for reintubation. The first group includes those having undergone head-neck surgery that may induce upper airway compression, whereas the second group comprises those having received operation for the central nervous system (i.e., the two patients undergoing burr hole operation for subdural hematomas in this survey) who are likely to experience a prolonged period of impaired consciousness after the operation. Consistently, some studies have highlighted the impact of the consciousness level of the patients and the resulting respiratory problems on the extubation outcome, especially for those with primary brain injury or receiving neurosurgical operation.<sup>7,8</sup> In addition, the present study also showed that unstable hemodynamics in PACU caused by sepsis or internal bleeding was an important cause of reintubation.

In this survey, while only a relatively small proportion of patients (16.1%) were sent to PACU between 3:00 p.m. to 5:00 p.m. in our daily practice, six cases of reintubation (46.1%) took place within this narrow time window when nursing staff of day and night shifts are engaged in hand-over communications. The finding underscores the adverse influence of a combination of lack of concentration among hospital staff and a chaotic environment on the incidence of reintubation.

# Conclusions

Despite the small case number in this study, we were still able to discover some causes of reintubation which could be the patients' preoperative general condition, the types of operations, anesthetic technique adopted, and the choice of anesthetic drugs. On the other hand, the experience and concentration of the staff are also very important. Although reintubation rate and risk factors could vary with time and individual hospitals, identifying the reasons for reintubation may guide the implementation of specific strategies for reducing their occurrence.

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