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Outcomes of unplanned extubation in ordinary ward are similar to those in intensive care unit

A STROBE-compliant case–control study

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Abstract

Unplanned extubation (UE) may cause considerable adverse effects in patients receiving mechanical ventilation (MV). Previous literature showed inconsistent prognosis in patients with UE. This study aimed to evaluate the clinical implications and outcomes of UE.

The intubated adult patients with MV support in our hospital were enrolled, and they were divided into the UE and non-UE groups. Demographic data, admission unit, MV duration, overall weaning rate, and mortality rates were compared. The outcomes of UE in ordinary ward and intensive care unit (ICU) were also assessed.

Totally 9245 intubated adult patients were included. UE occurred in 303 (3.5%) patients, and the UE events were 0.27 times/100 MV days. Old age, nonoperation related MV cause, and admission out of the ICU were significant factors associated with UE events. UE patients showed a trend of better overall weaning rate (71.9% vs 66.7%, $P = .054$) than non-UE. However, the in-hospital mortality rate (25.7% vs 24.8%, $P = .713$) were similar between the UE and non-UE patients. The reintubation rate of UE patients was 44.1% (142/322). Successful UEs were associated with patients in weaning process (52.8% vs 38.7%, $P = .012$), and patients received non-invasive positive pressure ventilation (NIPPV) support after UE (19.4% vs 3.5%, $P < .001$). Patients with successful UE had significantly shorter MV days, higher overall weaning rate, and lower mortality than those with unsuccessful UE. Outcomes of UE in ordinary ward and in ICU had similar MV duration, reintubation rate, overall weaning rate, and in-hospital mortality rate.

The overall weaning rate and in-hospital mortality rates of the UE and non-UE patients were similar. UE occurred in ordinary ward had similar outcomes to those in ICU. Patients receiving MV should be assessed daily for weaning indications to reduce delayed extubation, and therefore, may decrease UE occurrence. Once the UE happened, NIPPV support may reduce the reintubation rate.

Abbreviations: APACHE II = Acute Physiology and Chronic Health Evaluation II, ICU = intensive care unit, IDS = integrated delivery system, IQR = interquartile range, MV = mechanical ventilation, NIPPV = noninvasive positive pressure ventilator, OP = operation, OR = odds ratio, RCC = respiratory care center, SD = standard deviation, UE = unplanned extubation.

Keywords: intubation, mechanical ventilation, noninvasive positive pressure ventilation, unplanned extubation

1. Introduction

Unplanned extubation (UE) is defined as self-removal of an endotracheal tube by a patient receiving mechanical ventilation (MV) support or accidental removal by a staff during nursing care.[1] UE is an important adverse event in critically ill patients and a medical emergency because immediate reintubation is frequently required. According to the previous literature, the incidence rate of UE ranges from 0.5% to 35.8% and 0.1 to 4.2 events/100 intubation days.[1–5] The immediate complications after UE include laryngeal or vocal cord injury, hypoxemia, respiratory failure, tachyarrhythmia, hypotension, aspiration pneumonia, and even death.[1,4]

The reintubation rate in patients with UE ranges from 1.8% to 88%, and these patients are at a higher risk of difficult intubation and hypoxemia.[1,3,5,6] Mort[7] performed a study on 61 patients who had reintubation within 3 days after UE. In total, 54 (89%) patients required reintubation within 2 hours, and 40 (66%) patients were reintubated within 30 minutes. The causes of failed UE include hypoxemia, hemodynamic instability, secretions, upper airway obstruction, and encephalopathy.[3] It was also reported that patients with accidental extubation had worse prognosis and higher reintubation rate than those with self-extubation.[4,8]

Some studies have revealed that UE patients had longer ventilator support days, intensive care unit (ICU) stay, and hospitalization duration.[2,9–12] However, De Groot et al[13] claimed that UE patients had significantly shorter ICU stay and lower in-hospital mortality rate ($P < .05$). On the other hand, some studies have shown that UE patients had a lower ICU

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mortality rate and that UE was not associated with in-hospital mortality rate.[2] Those patients with failed UE had worse prognosis, longer ventilator-support days, and higher in-hospital mortality rate when compared to successful UE patients ($P < .001$).[13]

Studies within the last 20 years have reported a variable incidence rate of UE and inconsistent prognosis. In our hospital, the number of patients on MV support exceeds the number of ICU beds. Thus, some patients had to be admitted in an ordinary ward before being transferred to the ICU. No previous literature has compared the difference in the outcome of UE between patients admitted in an ordinary ward and the ICU. In addition, the association between UE and overall weaning rate was not previously assessed. In this study, we aimed to evaluate the incidence rate, reintubation rate, associated factors, and outcome of UE in adult patients. Moreover, the outcomes difference of successful UE, failed UE, UE in ordinary ward, and UE in ICU were assessed.

2. Methods

2.1. Patient selection

This retrospective case–control study was conducted in a 1455-bed tertiary medical center in southern Taiwan. There are 77 intensive care beds in the ICU and 16 beds in the respiratory care center (RCC). We selected adult patients on MV support from January 1, 2010 to June 30, 2013. Patients aged < 20 years, those with long-term tracheostomy, and those admitted in the emergency room or postanesthesia care unit were excluded. Then the patients were divided into the UE and non-UE groups to compare the clinical features and outcomes. The study was approved by the institutional review board of Kaohsiung Veterans General Hospital (IRB no.: VGHKS14-CT2-02).

RCC is a specialized weaning unit that was established according to the integrated delivery system (IDS) policy of Taiwan National Health Insurance Bureau. The IDS policy includes 4 stages of care for patients on MV support: 1st stage, ICU care at 1–21 days of MV; 2nd stage, RCC care at 21–63 days; 3rd stage, chronic respiratory care unit for patients on long-term MV support > 63 days; and 4th stage, an optional choice: home care of MV-dependent patients. RCC is an intermediate respiratory care unit with 24-hour vital sign monitoring and nursing for patients on prolonged MV, and the primary aim was MV weaning. The nurse-to-patient ratios were 1:2 in the ICU, 1:4 in the RCC, and 1:6–8 in the ordinary ward at daytime and 1:12–15 at night time.

2.2. Measurement

The medical records of the patients were also reviewed, and the following data were collected: age, sex, Acute Physiology and Chronic Health Evaluation II (APACHE II) score upon ICU admission, MV days at UE, admission unit at UE, MV mode at UE, causes of MV (operation or nonoperation-related), level of consciousness at UE, sedation status at UE, noninvasive positive pressure ventilation (NIPPV) use after UE, duration of MV, overall weaning rate, and in-hospital mortality rate. UE is defined as self-removal of endotracheal tube by the patient or accidental removal by a staff during nursing care. All the UE events were reported and recorded in the Patient Safety Reporting System of our hospital. The leaders of the care unit would discuss with related personnel to determine the factors contribute to UE. The causes of UE were collected according to these event reports in the system.

For patients who were never transferred in the ICU, the APACHE II score was calculated after 24 hours of intubation. For patients in the acute stage of critical illness or unconsciousness, full-support ventilation mode was used. For patients with improvements of respiratory failure and medical condition, partial support ventilation mode was utilized to perform the weaning process (pressure support mode or T-piece device). The criteria for the weaning process include $PaO_2/FIO_2 \geq 150$–200, $FIO_2 \leq 0.4$–0.5 with $PaO_2 \geq 60$ mm Hg, PEEP ≤ 5–8 mm Hg, pH ≥ 7.25, and stable hemodynamic condition, with spontaneous breathing capacity.

Clear consciousness is defined as a Glasgow coma scale score of ≥10. A patient on intravenous benzodiazepine or propofol was considered as receiving sedation. UE patients were divided into the successful UE and failed UE groups. A failed UE is defined as reintubation that is required within 48 hours after UE, whereas a successful UE is defined as absence of reintubation within 48 hours. The need for reintubation was based on the judgment of a physician, according to medical conditions such as respiratory acidosis, hypoxemia, respiratory distress, inability to protect airway, or unstable hemodynamics. The overall weaning rate is defined as the percentage of successful weaning from ventilator > 48 hours at the end of hospitalization. Failed weaning is defined as continuous MV support or death at discharge.

2.3. Statistical analysis

Data collection was performed using Excel 2010 (Microsoft). SPSS Statistics for Windows, Version 20.0 (IBM Corp., Armonk, NY) was used for statistical analysis. Continuous data were presented as mean ± standard deviation, or median (interquartile range, IQR). Independent *t*-tests or Mann–Whitney *U* tests were used to compare differences of means or medians between 2 independent groups. For noncontinuous variables, the chi-square test or Fisher's exact test was used to determine differences. Binary logistic regression was used to identify factors associated with reintubation after UE. A *P* value of $< .05$ was considered statistically significant.

3. Results

From January 1, 2010 to June 30, 2013, a total of 9375 patients on MV support were collected. However, 130 patients aged < 20 years were excluded. Finally, 9245 adult patients were enrolled. The mean age was 66.8 ± 16.6 years, and the median MV day was 6 days (IQR: 2–16 days). UE occurred in 303 (3.5%) patients. Moreover, 17 patients had repeated UE. (2 patients had 3 times of UE). Therefore, a total of 322 UE events were recorded, with a UE rate of 0.27 times/100 MV days. The trend of UE ranges from 0.24 to 0.28 time/100 MV days, and was shown in Figure 1. There was no significant UE rate difference between each year.

The median MV day at UE event was 6.5 days (IQR: 3–13 days). Importantly, 181 (56%) of 322 UE events occurred within the first week of MV, and the incidence was highest on the second day (47/322, 14.6%, Fig. 2). At time of UE events, 78.9% of the patients were conscious, and 72.1% did not receive sedation. UE patients were significantly older than non-UE patients (70.1 ± 15.9 vs 66.7 ± 16.6 years, $P < .001$). UE was significantly associated with nonoperation-related MV (78.9% vs 58.3%, $P < .001$) and admission in ordinary ward (31.7% vs 24.6%, $P = .004$) (Table 1). The MV duration was significantly longer in

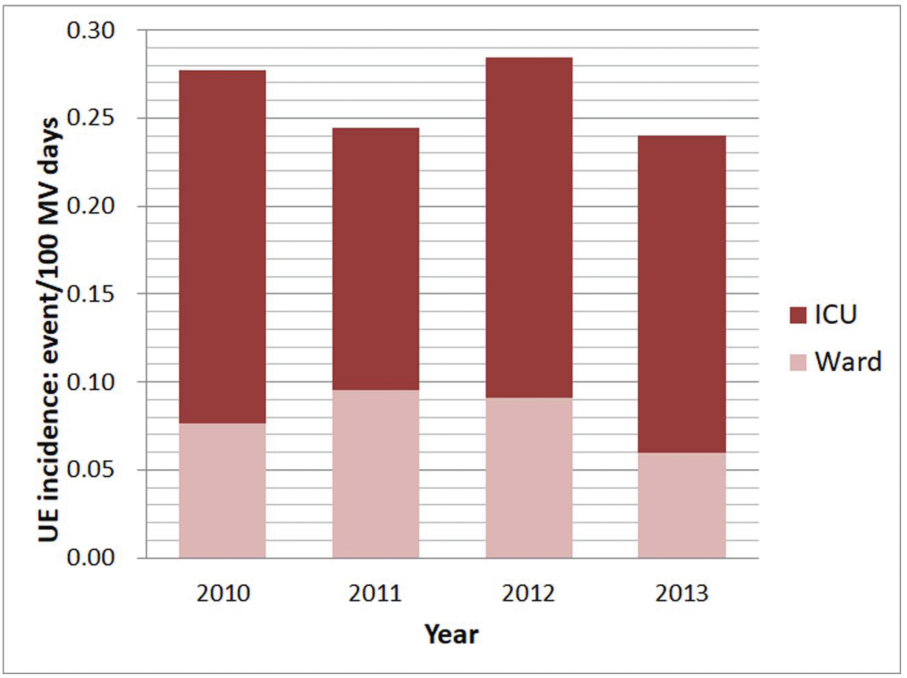

Figure 1. Trend of UE rate and percentage of UE in ward: 2010-2013. The trend of UE incidence ranged from 0.24 to 0.28 time /100 MV days, and Ward/ICU ratio of UE events ranged from 0.25 to 0.39. There were no statistical UE incidence differences between each year during the study period. *P*-value = .66. Study period was from January 2010 to June 2013. UE = unplanned extubation.

UE patients than in non-UE patients, with median day (IQR): 13 (6–28) days vs 6 (2–16) days, $P < .001$. There was a trend of better overall weaning rate in UE patients (71.9% vs 66.7%, $P = .054$). In contrast, in-hospital mortality rates (25.7% vs 24.8%, $P = .713$) were similar in both groups. The overall weaning rate of all patients on MV in our study was 66.8%. There were usually multiple causes contribute to a UE event. The 3 most common causes of UE were improper physical restraint, patient agitation, and delayed extubation (Table 2).

The reintubation rate of UE patients was 44.1% (142/322), and 89 (62.7%) patients were reintubated within 30 minutes. Moreover, 137 (96.5%) patients were reintubated within 1 day. Besides, 46.7% of patients who had a successful UE were still on full-support MV when UE occurred. Patients who had a

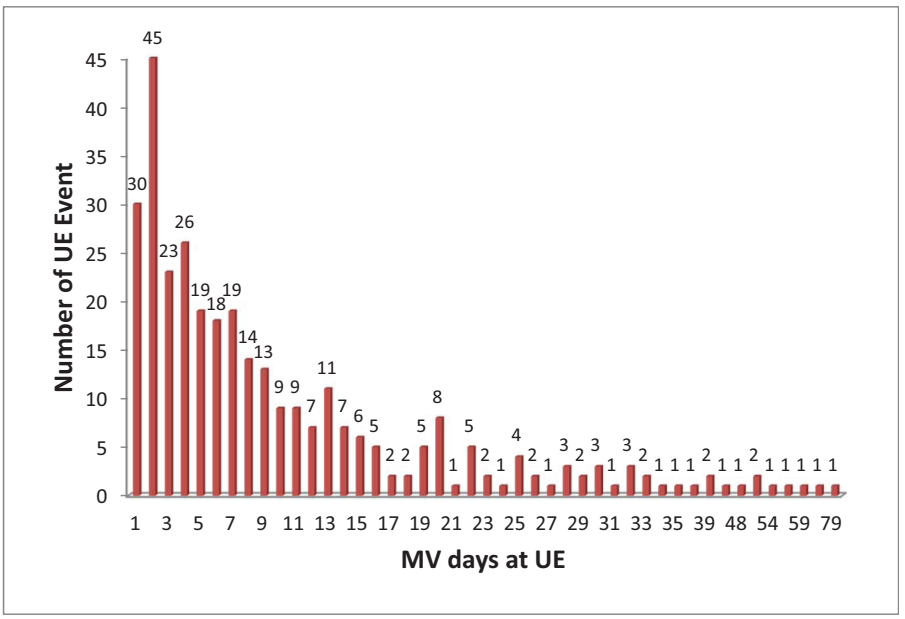

Figure 2. Timing of unplanned extubation during mechanical ventilation. In total, 181 of 322 UE events (56%) occurred within the first week of MV support. The median MV day at UE was 6.5 days (IQR, 3–13). IQR = interquartile range, UE = unplanned extubation.

Table 1

Characteristics of unplanned extubation and nonunplanned extubation patients.

Variables	UE (n = 303)	Non-UE (n = 8942)	*P* value
Male, %	72.3	68.3	.139
Age, year ± SD	70.1 ± 15.9	66.7 ± 16.6	< .001
Type of UE*			
Self extubation	299 (92.9)		
Accidental removal	23 (7.1)		
Stay unit*, n (%)			
ICU	220 (68.3)	6746 (75.4)	.004
Ordinary ward	102 (31.7)	2196 (24.6)	
Cause of MV, n (%)			
Post-OP	64 (21.1)	3730 (41.7)	< .001
Non-OP	239 (78.9)	5212 (58.3)	
MV duration, median day (IQR)	13 (6–28)	6 (2–16)	< .001
Overall weaning rate, n (%)	218 (71.9)	5960 (66.7)	.054
In-hospital mortality, n (%)	78 (25.7)	2219 (24.8)	.713

APACHE II = Acute Physiology and Chronic Health Evaluation II, ICU = intensive care unit, IQR = interquartile range, MV = mechanical ventilation, OP = operation, RCC = respiratory care center, SD = standard deviation, UE = unplanned extubation.

* Admission unit was analyzed according to the total 322 UE events. ICU includes adult ICU and RCC in this study.

Table 2

Causes of unplanned extubation.

Causes of UE	Number	Percentage*
Improper physical restraint	210	65.2
Patient agitation	116	36
Delayed extubation	76	23.6
Absence of physical restraint	68	21.1
Caregiver quality	67	20.8
Endotracheal tube discomfort	28	8.7
Inadequate sedation	27	8.4
Inadequate endotracheal tube fixation	10	3.1
Nursing care induced	4	1.2

UE = unplanned extubation.

* Percentage was calculated by number/322. Each UE event may have multiple causes. There were totally 322 UE events in our study.

successful UE had a significantly lower APACHE II score (19.1 ± 6.4 vs 21.5 ± 7.6, $P = .006$), lower percentage of accidental removal of endotracheal tube (4.4% vs 10.6%, $P = .034$), higher percentage in weaning process (52.8% vs 38.7%, $P = .012$), and higher percentage receiving NIPPV support after UE (19.4% vs 3.5%, $P < .001$) (Table 3). In other words, patient entering the weaning mode of MV before UE had a lower reintubation rate (36.7% vs 50.6%). NIPPV after UE was also associated with a lower reintubation rate (12.5% vs 48.6%). Multivariate analysis showed that weaning mode at UE (OR = .591, $P = .023$) and NIPPV after UE (OR = .167, $P < .001$) were independent factors associated with lower reintubation rate.

Compared the outcomes of patients with failed UE, those with successful UE had significantly shorter MV duration (median 8 days vs 25 days, $P < .001$), higher overall weaning rate (89.5% vs 48.9%, $P < .001$), and lower in-hospital mortality rate (17.4% vs 36.6%, $P < .001$, Table 4). Among the 322 UE events, 220 occurred in the ICU, whereas 102 occurred in an ordinary ward. Compared to patients having UE in ICU, those who had UE in an ordinary ward were significantly older (73.9 ± 12.5 vs 68.7 ± 17 years, $P = .002$), had more UE due to accidental removal (13.7% vs 4.1%, $P = .002$), and had lower percentage of operation (2% vs 28.6%, $P < .001$). The MV duration, reintubation rate, overall weaning rate, and in-hospital mortality rate of UE were not significantly different between patients in ordinary ward and the ICU (Table 5).

4. Discussion

4.1. Baseline features and risk factors of UE

In our study, UE occurred in 3.5% of all intubated adult patients, and this result was consistent with the largest UE study in Taiwan (3.19%, 1404 episodes of UE).[3] In our patients, the majority of UE occurred within the first week of intubation (55.9%), and the incidence rate (14.6%) of UE was the highest on day 2. This was consistent with previous study by Chen et al,[14] in which the incidence rate of UE was the highest on day 1 (30%, 15/50), followed by day 2 (22%, 11/50).

Table 3

Comparison of the characteristics of patients with successful and failed unplanned extubation.

			Univariate	Multivariate	
	Successful UE (n = 172)	Failed UE (n = 131)	*P* value	*P* value	OR (95%CI)†
Male, %	75	68.7	.225		
Age, year ± SD	68.9 ± 15.7	71.6 ± 15.9	.150		
APACHE II score	19.1 ± 6.4	21.5 ± 7.6	.006	.166	1.010 (.996–1.025)
Type of UE, n (%)*					
Self extubation	172 (95.6)	127 (89.4)	.034	.150	reference
Accidental removal	8 (4.4)	15 (10.6)			1.958 (.784–4.892)
Stay unit, n (%)					
ICU*	120 (66.7)	100 (70.4)	.472		
Ordinary ward	60 (33.3)	42 (29.6)			
Clear consciousness*, n (%)	147 (81.7)	107 (75.4)	.168		
Sedation*, n (%)	49 (27.2)	42 (29.6)	.641		
MV days at UE, median (IQR)*	7 (3–13)	6 (2–14)	.655		
Weaning mode at UE*, n (%)	95 (52.8)	55 (38.7)	.012	.023	0.591 (.375-.929)
NIPPV post UE*, n (%)	35 (19.4)	5 (3.5)	< .001	< .001	0.167 (.063-.442)

* The total number of UE events (322) were used for analysis: successful UE = 180, failed UE = 142. ICU includes adult ICU and RCC in this study.

† The OR of multivariate analysis represents the odds ratio for failed UE, which means reintubation occurred within 48 hours after UE.

APACHE II = Acute Physiology and Chronic Health Evaluation II, ICU = intensive care unit, IQR = interquartile range, MV = mechanical ventilation, OP = operation, OR = odds ratio, RCC = respiratory care center, SD = standard deviation, UE = unplanned extubation.

Table 4

Comparison of the outcomes of successful and failed unplanned extubation.

	Successful UE (n = 172)	Failed UE (n = 131)	*P* value
MV duration, median day (IQR)	8 (4–16.75)	25 (12–47)	< .001
Overall weaning rate, n (%)	154 (89.5)	64 (48.9)	< .001
In-hospital mortality, n (%)	30 (17.4)	48 (36.6)	< .001

IQR = interquartile range, MV = mechanical ventilation, SD = standard deviation, UE = unplanned extubation.

Table 5

Comparison of the features and outcomes of UE in the ICU* and ordinary ward.

	UE in the ICU* (220 events)	UE in the ward (102 events)	*P* value
Age, years ± SD	68.7 ± 17	73.9 ± 12.5	.002
Male, %	73.2	70.6	.628
APACHE II score	20.3 ± 7.4	20.3 ± 6.8	.950
Type of UE			
Self extubation	211 (95.9)	88 (86.3)	.002
Accidental removal	9 (4.1)	14 (13.7)	
Post-OP, n (%)	63 (28.6)	2 (2)	< .001
MV duration, median day (IQR)	15 (7–33)	11.5 (5.75–26)	.108
Reintubation rate, n (%)	100 (45.5)	42 (41.2)	.472
Overall weaning rate, n (%)	156 (70.9)	74 (72.5)	.762
In-hospital mortality, n (%)	53 (24.1)	28 (27.5)	.518

* ICU includes adult ICU and RCC in this study.

APACHE II = Acute Physiology and Chronic Health Evaluation II, ICU = intensive care unit, IQR = interquartile range, MV = mechanical ventilation, OP = operation, RCC = respiratory care center, SD = standard deviation, UE = unplanned extubation.

Moreover, around 70% of UE patients were conscious at the time of UE. It has been reported that higher consciousness level and/or inadequate sedation were evident risk factors of UE.[2,4,15–18] Increased frequency of physical restraint was also observed in patients with UE due to high consciousness level.[2] Particular attention should be provided to these patients, and adequate sedation and pain control are necessary in the early stage to decrease UE.

Several reports have claimed that age does not influence UE.[15,18–21] However, Chuang et al[2] showed that younger age is correlated to UE. However, in our study, patients in the UE group were older, which was not compatible with previous literature. Non-operation-related MV support is another factor associated with UE ($P < .001$) in our study. Moons et al[16] reported a substantially higher incidence rate of UE in the medical ICU than in the surgical ICU (9.5% vs 2.6%), and another 2 studies also showed similar trends.[17,19] However, this correlation was not found in other studies.[15,18,21]

In addition, nonadmission to the ICU was significantly associated with UE. This situation is unique to our hospital because the number of patients on MV is frequently more than the available ICU beds. Therefore, around 1/4 intubated patients with MV support had to stay in an ordinary ward while waiting for an available ICU bed. The nurse-to-patient ratio in an ordinary ward was significantly lower than that in the ICU. Curry et al[22] have reported that 89% of UE occurred when nursing staffs were away from bedside. In our study, up to 61 UE events in ward were attributed to inadequate caregiver quality, whereas only 6 UE events in ICU were attributed to this reason. Therefore, we also suggest caregiver quality and manpower may be associated with UE.

ICU admission is obviously better for patients with MV, for it may reduce UE events. However, the trend of population ageing keeps increasing, and ICU inadequacy will become inevitable. This trend of ICU shortage was also demonstrated in a study by Lieberman et al[23] in Israel. In this study, they revealed that 38.4% of MV patients distributed outside the ICU, and up to 51.1% of elderly patients (> 65 years) with MV support were treated outside the ICU.[23] It can be expected that the growing number of elderly patients with multiple comorbidities will result in increasing shortage of ICU beds, and more MV patients distributing in ordinary ward. In our hospital, we assemble these excessive MV patients to a single ordinary ward which had better MV care ability. This ward consists of more senior nurses trained for ventilator management. During the night time, senior duty doctors were assigned to handle clinical problems in the ward. This may be a reasonable alternative solution in situation of ICU inadequacy. However, the nursing manpower and care quality were still inferior to that in ICU.

The trend of UE rate showed a decrease fashion in previous 2 long-term studies by Chao et al (15-year period in adult patients, from 0.9 to 0.14/100 MV days) and by Al-Abdwani et al (11-year period in pediatric patients, from 0.92 to 0.37/100 MV days).[3,5] The insignificant change of UE trend in our study might be due to the relative short study period. The UEs in our study usually resulted from multiple reasons. Therefore, multifactorial approach is reasonable to prevent UE. Multidisciplinary intervention such as revising sedation and weaning protocol, improving strategy for physical restraint, and new method for endotracheal tube fixation, had shown to decrease UE rate.[3]

4.2. Factors associated with successful UE

In our study, the reintubation rate within 48 hours of UE was 44.1%, which indicates that 55.9% of patients had successful UE. This is similar to the reintubation rate of 38.7–65.1% in previous studies on UE in Taiwan.[3,6] The factors associated with failed UE include full-assist ventilation mode, pH ≥7.45, PaO_2/FIO_2 of < 250 mm Hg, heart rate of > 120 bpm within 24 hours before UE, ≥3 comorbidities, unconsciousness, and nonoperation patient.[24] However, the factors did not significantly affect the UE reintubation rate in a study by Chen et al[14] on medical ICU patients in Taiwan.[14] In their conclusion, the only significant factor associated with higher reintubation rate is pneumonia-related respiratory failure ($P = .02$).

In our study, weaning process at UE and NIPPV support after UE are the 2 significant factors associated with successful UE. In contrast, age, sex, nonadmission to the ICU, level of consciousness, sedation, and MV days at UE do not influence the reintubation rate. Epsentin et al[9] also reported a significantly lower reintubation rate in UE occurred during weaning process (30% vs 76%, $P < .001$), which is similar to our result. Eryüksel et al[25] provided NIPPV to 15 UE patients who received pressure support ventilation mode before UE and found that the reintubation rate was 33.3% (5/15). This is also in accordance with our study result showing that NIPPV support for UE patients was associated with a lower reintubation rate. Although this is a retrospective study, we still consider NIPPV support as a potential choice of treatment for UE patients without contraindications to NIPPV to decrease the reintubation rate.

4.3. Prognosis of UE

The overall weaning rate of UE patients showed a better trend than that of non-UE patients, although the result was not statistically significant (71.9 vs 66.7%, $P = .054$). To the best of our knowledge, the overall weaning rate was never evaluated in previous studies. This study first showed that UE does not negatively affect the overall weaning rate of patients with MV. Several studies have reported about longer MV, ICU, and hospital days in UE patients.[2,9–12] However, de Groot et al. have shown lower MV and ICU days despite the fact that the result was not statistically significant ($P = .07$ and .1).[13] In terms of in-hospital mortality in UE patients, some studies have shown significantly lower mortality rate than the controls.[10,13] However, other studies did not show any significant differences in terms of mortality rate.[2,9,12]

In a previous literature, results showed that failed UE was more associated with worse prognosis than successful UE,[9–13] and our study also showed similar result. Patients who experienced failed UE had significantly longer MV duration, lower overall weaning rate, and higher mortality than those who had a successful UE in our study.

Our study had several limitations. This was a single-center retrospective study, and our result may not be representative of the whole population. We only evaluated the in-hospital mortality rate, but the mortality rate after discharge and 1-year mortality rate were not assessed. Moreover, we did not obtain the APACHE II score of the non-UE group. However, the present study has key strengths. This study first compared the overall weaning rate between UE and non-UE patients. We included 9245 adult patients on MV who did or did not experience UE. Moreover, this study first assessed the clinical features of UE in patients admitted in an ordinary ward and the ICU.

5. Conclusion

Our study result suggests that UE itself was not a signal of worse prognosis, but was more likely implying delayed extubation and inadequate caregiver quality. For MV support, ICU is a better unit than an ordinary ward in terms of nursing care and patient monitoring, however, the outcome of UE in the 2 kinds of unit was not different. Patients on MV should be thoroughly assessed for weaning criteria and suitability for extubation to minimize weaning delay and UE. Physical restraint, awareness of the caregiver, and adequate sedation for conscious patients are important in the care of intubated patients, especially within the first week of MV period, to prevent UE. Once UE occurs, NIPPV support is possibly an effective method in reducing the reintubation rate in patients without contraindications.

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