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Risk factors and outcome after unplanned extubations on the ICU, a case-control study

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Abstract

Introduction: Unplanned extubation (UE) is a frequent event during mechanical ventilation in critically ill patients and is possibly associated with increased morbidity and mortality. However, detailed knowledge on risk factors and outcome after UE is lacking.

Methods: A case-control study was performed with a case to control ratio of 1:4. Incidence density sampling was applied. Seventy-four cases and 296 control patients were included.

Results: 74 UEs occurred in 69 patients, comprising 2% of all mechanically ventilated patients. Multivariable regression analysis revealed that the first and second category of the Ramsay Sedation Score were associated with a high risk for an UE (odds ratio (OR) = 30, OR = 25, respectively). Male gender, subunit of ICU, length of stay in the ICU and midazolam use at time of UE were also risk factors for an UE. Patients with an UE had lower hospital mortality than mechanically ventilated patients without UE, respectively 10% versus 30%. Forty-seven percent (n = 35) of the patients with an UE had to be reintubated.

Conclusions: The present study showed that the first and second category of the Ramsay Sedation Score were associated with a high risk for an UE. Also male gender and use of midazolam at time of UE were identified as risk factors for an UE. However, compared

to mechanically ventilated controls, no increased mortality was shown for UE. In UE patients without need for subsequent reintubation mortality was very low.

Introduction

Unplanned extubation (UE) is a frequent event after endotracheal intubation for respiratory support in critically ill patients and is associated with increased morbidity and mortality [1-12]. The incidence of UE among intubated patients is reported to vary from 0.3% [7] to 14% [7,13], depending on patient characteristics, characteristics of the intensive care units surveyed and the duration of mechanical ventilation of the patients [14]. UEs account for approximately 10% (3-16%) of extubations, and require reintubation in 60% of the cases [4]. Furthermore, experiencing an UE is associated with prolonged duration of mechanical ventilation, intensive care unit (ICU) stay and hospital stay compared to not having experienced an UE [4,15,16]. Reported risk factors for UE include route of tracheal intubation, method of tube fixation [3], method and level of sedation [3,17].

Unplanned extubation is defined as a premature removal of the endotracheal tube by action of the mechanically ventilated patient (deliberate unplanned extubation) [17] or premature removal during nursing and medical care (accidental extubation) [18]. Although UE has been studied regularly, still many questions about incidence, determinants, and outcome of UE are not answered in all detail. Moreover, inconsistent findings exist, especially with respect to outcome after UE, with some authors reporting

an improved outcome after UE [14,15]. This may be explained by differences in study design, study population, and ICU characteristics.

Understanding the determinants of UE is critical for risk assessment in individual patients and for developing interventions to reduce the incidence of this mechanical ventilation complication. We therefore aimed to study the incidence, determinants and outcome of UE and to asses the risk factors for reintubations in full detail. The tertiary-care ICU setting in which this case control study was performed represents the full spectrum of clinical problems compared to other studies. Furthermore, we were able to obtain extensive clinical information for cases and controls based on automated clinical data registers.

Methods

Design and Definitions

This prospective case control study was conducted in a tertiary-care ICU. From December 1, 2005, to June 1, 2008 all patients requiring an artificial airway (orotracheal or nasotracheal tube) at one of the three subunits of the ICU of the Leiden University Medical Center, the Netherlands, were monitored for the occurrence of an UE. Cases were consecutive patients with an UE in the study period. For the purpose of the study UE was defined as premature removal of the endotracheal tube by action of the patient. Patients who experienced an accidental extubation during nursing and medical care were not included as case.

For selection of controls incidence density sampling was used, thereby matching the controls on time [19]. For every occasion of an UE, four control patients were

randomly selected, from all mechanically ventilated ICU patients present at the time an UE occurred. Controls were not matched to cases with respect to clinical characteristics such as age and sex. The reason for not matching on such variables was twofold: Firstly, after matching, the effect of the matched variables on the outcome can not be assessed any more; secondly, matching can introduce bias in case-control designs.

The study conforms to the provision of the Declaration of Helsinki in 1975 (revised in 2008, Seoul) [20]. None of the patients was exposed for study purposes to any intervention. Given the observational nature of the study and the fact that collecting information on UE is standard practice of both the Safety Management Policy of our hospital and of the quality practice of the Dutch Association of Intensivists, informed consent according to the local institutional review board was not deemed necessary.

Study setting and treatment procedures

Patients were included from the three adult tertiary-care ICU subunits at the Leiden University Medical Centre (LUMC) with a capacity of 29 beds. Each subunit facilitates the mixed ICU population, although some preference exists for surgical patients to be allocated to the two subunits in the vicinity of the operating rooms. The population represents a mixture of patients with complex medical conditions and patients undergoing planned and emergency surgical, thoracic-surgical and neurosurgical procedures. The ICU is staffed by board-certified critical care specialists, trainees in critical care medicine, and medical residents, providing 24-h in-unit coverage. Nursing staff works in three shifts, 7.30 am to 3 pm, 3 pm to 10.30 pm, and 10.30 pm to 7.30 am. Patient to

nursing staff ratio is 1½:1 during day time, 1¾:1 in the evening, and 2:1 during night time.

The preferred route of intubation at our institution is oral. Tracheal tubes are routinely secured with cotton tape tied around the head. Physical restraints are used when deemed necessary by the nursing staff. Either midazolam or propofol, alone or in combination with morfin, methadon or sufentanil is used for sedation. In every patient the ventilatory support and the level of sedation are adjusted to the specific clinical requirements. Furthermore, we systematically applied a weaning protocol, on all participating ICU units. In the weaning protocol are stated (I) Criteria for start of the weaning process. These include: 1. Reversal of initial critical illness. 2. Adequate oxygenation with respect to inspiratory oxygen $FiO2 < 0.5$ $pO2/FiO2$ ratio > 20-26 kPa, pH > 7.25 and positive end expiratory pressure (PEEP) < 6. 3. Hemodynamic stability with respect to use of vasopressors (noradrenaline < 0.1 γ) and/or inotropes (dobutamine < 5 γ). 4. The ability to deliver work of breathing with respect to negative inspiratory pressure > - 5 cm H2O and adequate tidal volume. Also stated in the protocol are (II) The two ways of Spontaneous Breathing Trial (SBT) that are used in our daily clinical practice (T-piece or CPAP with 5 cm H2O) and the (III) Criteria to evaluate the SBT. The latter criteria include 1. Gas exchange remains adequate with respect to pH > 7.35, Δ $pCO2 < 1.3$ kPa, $pO2 > 7.4$ kPa and oxygen saturation > 90%. 2. Hemodynamic stability is not impaired with respect to HR < 130/min, Δ HR < 20% and systolic BP 90 - 200 mmHg and Δ BP < 20%. 3. Ventilation pattern remains stable with respect to respiratory rate (RR) < 30/min and Δ RR < 50% 4. Subjective tolerance of the patient with respect to signs of distress, vasovagal signs.

Data collection

Within 12 hours after the occurrence of an UE the researcher filled out the standardized Data Collection Tool (DCT) based on the electronical medical and nursing records. For a control patient the same DCT was filled out. Additional information was obtained by a standardized questionnaire for every case and control by interviewing the nurse who witnessed or discovered the UE or was involved in the care of the control patient. The standardized questionnaires were based on comprehensive literature review of previous unplanned extubation studies [1-4,6,16-18,21,22] and practical insights from the medical ICU staff. Information on complications and reintubations (within 48h) following the UE was obtained for each patient. Data extraction and monitoring of follow-up were equal for cases and controls.

Several strategies were established to enhance the implementation of the study: Information sessions were held before the start of the study to educate the ICU nurses and doctors on the study aim and procedures. Attention posters were clearly posted in all ICU units and the researcher visited the subunits daily to record the number of intubated patients and to implicitly remind the ICU staff about the study. Moreover, the researcher received bimonthly a report from the 'ICU incident database'. In this database incidents, such as UE, occurring on the ICU are registered. According to this database no UEs were missed. To select controls, all mechanically ventilated ICU patients were assigned a number and a random number generator selected four numbers. The four selected patients represent the control patients. Identical information was collected for these control patients.

Statistical Analysis

Continuous and ranked variables were compared through the Student's t test or Wilcoxon rank-sum test in case of non normal distribution and expressed respectively as mean ± SD or median and interquartile range. Categorical variables were expressed as percentages and analyzed using chi-squared test.

To determine independent risk factors for UE, univariate logistic regression was used. Determinants significantly associated with UE in the univariate analysis ($P < 0.25$) and clinically relevant factors were included in the multivariable logistic regression. All statistics were calculated using SPSS (version 16.0; SPSS Inc., Chicago, IL).

Results

Study population and patient characteristics

In the 30-month study period 4,255 patients were admitted to the ICU. Of these patients, 3476 (82%) patients required one or more mechanical ventilation periods, resulting in 17,398 ventilation days. Within the study period, 74 UEs occurred in 69 patients. Five patients experienced an UE twice. A total of 296 controls was included.

Demographic and clinical characteristics are reported in Table 1. Of all cases, the majority was male (77%). The median age of the cases was 61 years (range 47 to 75). UEs occurred more frequently during night shifts (38%) than during day or evening shifts. Cases and controls did not differ significantly with respect to age and diagnosis category or type of admittance.

Incidence of unplanned extubations

Of 3476 patients requiring mechanical ventilation, UE occurred in 69 patients. This translates in an incidence of UE of 2.0% for mechanically ventilated patients. The incidence rate of UE was 0.004 per ventilation day.

Determinants of unplanned extubations

Determinants that were associated with an UE in the univariate analysis are provided in Table 2. Male gender, higher body mass index (BMI), ICU subunit B with preferential surgical patients, an elevated serum sodium level at time of UE, low Ramsay Sedation Score (anxious/agitated and awake/cooperative), use of haloperidol and methadon at time of UE were associated with increased risk of UE.

In the multivariable analysis the following variables were associated with UE: ICU subunit, with an increased risk of UE in subunit B (OR = 2.6; 95% CI 1.06-6.53), length of stay (index time) in the ICU with an increased risk for patients with a shorter length of stay (OR = 0.9; 95% CI 0.93-0.99), first (anxious/agitated) and second (awake/cooperative) category of the Ramsay Sedation Score (OR = 30.6; 95% CI 3.18-294.20; OR = 25.5; 95% CI 2.99-216.96, respectively) and midazolam use at time of UE (OR = 2.3; 95% Cl 1.01-5.18).

Follow-up after unplanned extubations

Patients with an UE had a significantly lower hospital mortality than patients without an UE (19% versus 32%, P = 0.028). The difference persisted after correction for severity of disease (APACHE II), age, and type of admission, OR = 0.5, 95% CI 0.28 -1.00). Furthermore, patients with an UE had a shorter total intubation time (P = 0.074) and had a lower ICU mortality (P = 0.096), although these associations did not met the criteria for statistical significance (Table 3).

Forty-seven percent (35 of 74) of all instances of unplanned extubations did require a reintubation and 53% did not need a reintubation. Of the patients that had to be reintubated, all of them occurred within 12 hours of the UE (89% within one hour and 11% between 1-12 hours). Moreover, 66% had to be reintubated between 0-29 minutes and 23% between 30-59 minutes. Table 4 compares patients with an UE who did not need a reintubation with patients who did need a reintubation. Patients without reintubation had a significantly shorter length of stay in the ICU and in the hospital (10 versus 40 days and 28 versus 61 days, respectively), lower length of total intubation time

and lower ICU and hospital mortality. Thus, the outcome after UE seemed to depend on the need for reintubation.

Risk factors for reintubation after an UE were the level of PEEP (P = 0.05) and respiratory frequency before UE (P = 0.05). Mode of mechanical ventilation was not significantly associated with reintubation after an UE (P = 0.428). Furthermore, patients with pulmonary comorbidity had an increased risk of need for reintubation after an UE (P = 0.024). During ICU stay delirium and respiratory problems were other factors associated with the need for reintubation after an UE (P = 0.021 and P = 0.027 respectively).

Discussion

This study showed that UE occurred in 2% of all mechanically ventilated patients. Being awake or being agitated (Ramsay score 1 and 2), use of midazolam, and being admitted to a specific ICU subunit, was associated with an increased risk for UE. Analysis demonstrated that patients with an UE without subsequent need for reintubation had a lower ICU and hospital mortality than mechanically ventilated controls and also than UE patients in need of reintubation.

In the present study, we used a case-control design, which was also used in some other studies [1,5,15,17,18]. The case-control design enables to study the relationship of multiple factors for one outcome and is especially appropriate to study infrequent outcomes, such as UE. However, the selection of controls is crucial for a case-control study. The control group should be a random sample of all patients who were at risk to experience the studied outcome. In the present study the control group is sampled from all other mechanically ventilated patients admitted to the ICU at the time of an unplanned extubation. These patients are in principal at risk for an UE and represent the distributions of risk factors that will be compared to the distribution of risk factors in the cases, with respect to level of sedation. Both cases and controls had a Ramsay Sedation Score vary from Ramsay 1 to 6, pointing towards the appropriateness of the control group. We applied density sampling and control patients were matched on time. Consequently, it was possible that he/she served as control twice. Nevertheless, at both different time points the control patients were truly representative of the population the case arose from and were comparable to the case of that time point.

Reported incidences of UE differ largely, ranging from 0.3-14% [7,10,13,15,18]. These incidences are difficult to compare due to differences in calculation method of data collection of the various studies. Furthermore, the incidence variation can be partially explained by the heterogeneity of the studied ICU population [14]. The incidence of UE in our ICU was relatively low (2.1% for mechanically ventilated patients and 0.4% per ventilation day). This can partly be explained by the high nurse to patient ratio in our hospital. It is unlikely that underreporting is responsible for the low incidence, since in our institution parallel incident reporting systems at the ICU are used to minimize this effect. Furthermore, extensive attention was given to the implementation and execution of the study.

Male gender and subunit ICU were risk factors for UE. Remarkably, not only agitation and restlessness (Ramsay score one) predisposed to UE but also normal consciousness (Ramsay score two) was highly associated with UE. Our findings were consistent with other authors [1,11,13,17,18,23,24]. The observed agitation and restlessness could well be the clinical manifestations of delirium. We were capable to invest all medication use (narcotics and analgetics) at time of UE by means of the electronic medical records. The proportion of patients who received sedatives and narcotic analgetics was similar between the two groups. In the univariate model we found that the medication administered to decrease agitation and delirium, actually increased the risk of an UE. In the multivariable model midazolam was associated with an increased risk of UE. A possible explanation is that midazolam is known for its paradoxical reaction [25] and is also associated with delirium in ICU patients [26]. Furthermore, the relationship could be

confounded by the fact that agitated patients were more frequently treated with midazolam, and we were unable to completely correct for agitation. To get more insight into this process a future randomized controlled trial has to be established and could focus on the doses-response relationships, and could focus on goal-directed medication use. The subunit with an increased risk for UE distinguishes itself by a somewhat higher admittance rate of post-operative cardio-surgical patients. It is known that this patient subgroup is more likely to be agitated after surgery [27]. And although we corrected for type of patient (medical, surgical, thoracic surgical) this could be the explanation for the subunit effect. Factors that might have been a clarification in terms of subunit culture or care were not systematically collected and therefore not examined.

Previous studies [1-12], particularly before 2000, showed that UE was associated with higher risk for prolonged duration of mechanical ventilation, increased ICU stay, increased hospital stay and increased mortality. In the present study patients with an UE had better outcomes compared to control patients. This finding is not yet very well established in the literature on unplanned extubation although we were not the first to find this. Epstein (2000), Krinsley (2005) and Bouza (2007) also found that the outcome after an unplanned extubation was better compared to patients without UE. A first explanation could be that UE patients are in better clinical condition, more alert, physically stronger, and able to extubate themselves. And although not obvious from the baseline characteristics (Table 1) we can not exclude that this was the case. Secondly, earlier unplanned extubation could result in shorter duration of mechanical ventilation and ICU-LOS, and thus in less complications and improved outcome. The improved outcome of the UE patients not needing a reintubation is in concordance with this

hypothesis. Only a few other authors [5,14-16] described outcome differences between patients with UE with a subsequent need for reintubation and patients with UE not needing a reintubation. Krinsley and Bouza were the first to describe better outcomes for patients who experienced an UE and did not need a reintubation [14,15].

Another explanation for the improved outcome is that patients at our ICU are systematically intubated longer than they need to be. We do not know at what time patients with UE would have had their planned extubation but we hypothesized that the extubation success rate of the overall ICU population might provide additional insight. We have calculated our historic extubation success rate. In concordance with the literature we defined the extubation success rate as the proportion of patients in whom it was unnecessary to reinstitute ventilatory support within 48 hours after planned extubation [28]. Over the study period (1st January 2005 – 1st June 2008) we found that in 4710 patients, 931 needed a reintubation within 48 hours after planned extubation, resulting in an extubation failure rate of 19.8% and an extubation success rate of 80.2%. This could suggest that a proportion of our patients was indeed intubated longer than they needed to be despite our weaning protocol, and therefore at increased risk of UE. Maybe because it is not explicitly stated in our protocol how often patient should undergo a SBT, the SBT is not applied as frequently as it should to appoint patients that are eligible for extubation. Another hypothesis is that the medical and nursing staff is still reluctant towards extubation despite a weaning protocol. Awareness and education with respect to the weaning protocol and a more explicit mentioning of the frequency of SBTs could decrease this reluctance towards extubation and thereby reduce the length of mechanical ventilation time and maybe minimize the UE rate [1,2,18,29,30].

With respect to the UE patients who needed a reintubation it can be stated that in our institute a protocol for intubation and start of mechanical ventilation is applied with the following intubation criteria: 1. Upper airway obstruction, 2. Respiratory failure due to exhaustion, and 3. Impaired/decreased level of consciousness. Other criteria are: 4. Cardiopulmonary arrest, and 5. Need for sedation for diagnostic or therapeutic procedures. The fact that 90% of the reintubated UE patients needed reintubation within one hour is concordant with the risk factors for reintubation (high PEEP, respiratory frequency for UE, delirium during ICU stay and respiratory problems during ICU stay).

Some studies [1,13,18] have developed a clinical risk stratification tool to identify patients at risk for UE. These tools were mainly based on significant sedation and consciousness level of the patients. Our study observed additional risk factors. If patients are identified to have a high risk for UE, a temporarily intensified surveillance may be needed and extubation should be performed as soon as possible. ICU staff could make additional preventive measures (e.g. preventing agitation, adjust clear fixation policy, enforce 24-hours bedside supervision).These new policies will be an important area for further research investigations.

Conclusions

ICU patients who experienced an UE did not have increased mortality. Moreover, following an UE, patients not needing a reintubation had significant better outcomes compared to reintubated patients. Male gender, agitated or awake consciousness and use of midazolam at time of UE were identified as risk factors for an UE.

Key messages

- We introduce additional risk factors for unplanted extubation. Use of midazolam, and being admitted to a specific ICU subunit, was associated with an increased risk for unplanted extubation (UE).
- Analysis demonstrated that patients with an UE without subsequent need for reintubation had a lower ICU and hospital mortality than mechanically ventilated controls and also than UE patients in need of reintubation.
- Medical and nursing staff are reluctant towards extubation.
- Introduction of weaning/extubation protocols and daily evaluation of the need for mechanical ventilation could reduce the length of mechanical ventilation time and minimize the UE rate.

Competing interests

The authors declare that they have no competing interests.

Abbreviations

APACHE = Acute Physiology and Chronic Health Evaluation; BMI = Body Mass Index; DCT = Data Collection Tool; ICU = Intensive Care Unit; LOS = Length Of Stay; LUMC = Leiden University Medical Centre; PEEP = Positive End Expiratory Pressure; RR = Respiratory Rate; SBT = Spontaneous Breathing Trial; UE = Unplanted Extubation.

Authors' contributions

RG participated in the design and coordination of the study, carried out the data collection, performed the statistical analysis and drafted the manuscript. OD participated in the design of the study and sequence alignment of the manuscript. IH carried out a part of the data collection of the manuscript. EJ participated in the sequence alignment of the manuscript. MA conceived the study, participated in the design of the study, performed the statistical analysis and participated in the sequence alignment of the manuscript. All authors read and approved the final manuscript.

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Table 1: Demographic and clinical characteristics of the cases and controls

Variables		**Cases of UE (n=74)**	**Controls (n=296)**	**P value**
Age (y)		60.6 (±14)	61.2 (±16)	*0.22*
Males, n (%)		57 (77%)	188 (64%)	*0.03*
APACHE II[1]		16.4 (±8)	18.5 (±8)	*0.36*
Type of admittance[2], n	Medical	34 (46%)	135 (46%)	*0.82*
(%)	Planned surgery	30 (43%)	128 (43%)	*0.79*
	Urgent surgery	10 (14%)	33 (11%)	*0.65*
	Cardiovascular	39 (53%)	124 (42%)	*0.85*
Diagnosis	Respiratory	17 (23%)	74 (25%)	*0.33*
category, n (%)	Sepsis	2 (3%)	12 (4%)	*0.41*
	Neurological	9 (12%)	39 (13%)	*0.41*
	Gastrointestinal	5 (7%)	33 (11%)	*0.15*
	Vascular	1 (1%)	6 (2%)	*0.45*
	Metabolism	1 (1%)	1 (0,3%)	*0.56*
	Hematological	-	3 (1%)	*0.99*
	Renal	-	3 (1%)	*0.99*

[1] *APACHE II:* Acute Physiology and Chronic Health Evaluation.

[2] Type of admittance, *medical:* no surgery in the week before ICU admission, *planned surgery*: planned surgery, *urgent surgery*: immediate surgery where resuscitation, stabilization and physiological optimization simultaneously takes place with the surgery.

Table 2: Univariate and multivariable analysis; determinants that are associated with unplanned extubation

	Univariate		**Multivariable**	
Variables	**OR (95% C.I.)**	***P* value**	**OR (95% C.I.)**	***P* value**
Sex[1)]	1.9 (1.07-3.48)	*0.03*	1.8 (0.84-3.89)	*0.13*
Age (y)	0.9 (0.98-1.01)	*0.76*	1.0 (0.97-1.03)	*0.98*
BMI (kg/m2)	1.1 (1.00-1.10)	*0.04*	1.0 (0.97-1.11)	*0.26*
Subunit ICU[2)]		*0.02*		
ICU subunit A	1.2 (0.62-2.41)	*0.60*	1.0 (0.38-2.42)	*0.94*
ICU subunit B	2.2 (1.23-4.02)	*0.01*	2.6 (1.06-6.53)	*0.04*
Length of stay at time of UE (days)	0.9 (0.97-1.00)	*0.07*	1.0 (0.93-0.99)	*0.01*
Sodium (mmol/l) at time of UE	1.0 (1.00-1.09)	*0.05*	1.0 (0.97-1.11)	*0.26*
Ramsay sedation score at time of UE[5)]		*<0.01*		*<0.01*
1 Anxious/agitated	41.4 (4.84-354.05)	*<0.01*	30.6 (3.18-294.20)	*<0.01*
2 Awake/cooperative	15.2 (1.96-117.89)	*<0.01*	25.5 (2.99-216.96)	*<0.01*
3 Responds to commands only	6.4 (0.77-53.29)	*0.09*	7.0 (0.78-63.01)	*0.08*
4 Brisk response to loud noise	3.0 (0.29-31.01)	*0.34*	1.4 (0.12-15.97)	*0.79*
5 Sluggish response to loud noise	2.8 (0.29-26.59)	*0.37*	1.8 (0.17-18.42)	*0.62*
6 = reference; no response	1.0 (reference)	-	1.0 (reference)	-
Clonidine use at time of UE	2.3 (0.97-5.33)	*0.06*	2.3 (0.67-7.56)	*0.19*
Haloperidol use at time of UE	2.1 (1.24-3.51)	*0.01*	1.6 (0.66-3.72)	*0.31*
Methadon use at time of UE	2.0 (1.07-3.65)	*0.03*	0.9 (0.39-2.46)	*0.97*
Midazolam use at time of UE	1.4 (0.83-2.31)	*0.21*	2.3 (1.01-5.18)	*0.05*
Other benzodiazepine use at time of UE (diazepam, lorazepam, oxazepam, temazepam)	1.5 (0.85-2.55)	*0.16*	1.1 (0.48-2.69)	*0.77*

1) Reference category is female.
2) Reference is ICU subunit **C**.
3) Index time = sampling time for controls and time of UE for cases.
4) UE = unplanned extubation.
5) 6 = reference; no response.

Table 3: Clinical outcome, comparing cases with UE to mechanically ventilated controls

Outcome	Cases (n=74)	Controls (n=296)	Mean difference (95% CI)	*P*
Mean ICU-LOS[1)] at index time[2)] (days)	10	14	4 (0.68-8.34)	*0.021*
Mean ICU-LOS after UE[3)] (days)	14	16	2 (3.20-7.36)	*0.436*
Mean length of total intubation time (days)	23	29	6 (6.44-13.75)	*0.074*
Mean LOS ICU (days)	24	30	6 (1.15-13.78)	*0.097*
Mean LOS hospital (days)	43	48	5 (6.19-14.97)	*0.413*
Mortality ICU (n, %)	13 (18)	80 (27)	-	*0.096*
Mortality hospital (n, %)	14 (19)	95 (32)	-	*0.028*

1) LOS = length of stay.
2) Index time = sampling time for controls and time of UE for cases.
3) UE = unplanned extubation.

Table 4: Clinical outcome comparing UE patients with need for reintubation to UE patients without reintubation after UE. Following an UE (n=74), patients without reintubation had significant better outcomes compared to reintubated patients

Outcome cases	UE with reintubation (n=35)	UE without reintubation (n=39)	Mean difference (95% CI)	*P*
Mean LOS[1)] ICU, index time[2)] (days)	13	7	6 (12.29-0.23)	*0.059*
Mean LOS ICU, after UE[3)] (days)	26	3	23 (31.68-15.27)	*<0.001*
Mean length of total intubation (days)	38	9	29 (40.73-18.70)	*<0.001*
Mean LOS ICU (days)	40	10	30 (41.43-18.18)	*<0.001*
Mean LOS hospital (days)	61	28	33 (51.86-15.14)	*<0.001*
Mortality ICU (n, %)	13 (37)	0 (0)	-	*<0.001*
Mortality hospital (n, %)	13 (37)	1 (3)	-	*<0.001*

1) LOS = length of stay.
2) Index time = sampling time for controls and time of UE for cases.
3) UE = unplanned extubation.