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PRE EXTUBATION EVALUATION BY COMPARING COUGH PEAK FLOW AND COUGH STRENGTH SCORE

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ABSTRACT

Objective: To evaluate and compare the accuracy of cough strength score and cough peak flow in anticipating extubation results in patients admitted to ICU. **Methods:** Prospective, randomized and double-blind investigation was carried out in the period from June 2015 till October 2017 at Jinnah hospital, Lahore. 204 patients who were candidates for extubation after a successful spontaneous breathing test were included in this study. Cough strength score and cough peak flow were evaluated before extubation. Reintubation was recorded after three days of extubation. **Results:** Twenty-six patients required reintubation during the three days after planned extubation. Patients with successful extubation had higher cough strength score than patients who required reintubation. Cough strength score demonstrated a positive correlation with cough peak flow. There is an inverse relation between cough strength score and reintubation incidence. **Conclusions:** Cough strength score is an easy and applicable method to be recorded at the bedside. It is positively associated with CPF and had the same result for anticipating reintubation after scheduled extubation.

1. INTRODUCTION

Although there is an increased rate of complications after Intensive Caring Unit (ICU), few of these complications are unavoidable and might lead to medical emergencies. Extubation failure is one of these complications which is caused by extubation whether scheduled or not. Unscheduled extubation is one of the real problems which is encountered in all intensive care units worldwide, and especially in the mechanically ventilated patients. Extubation is the final step in weaning from intermittent positive pressure ventilation after a spontaneous breathing test. It is reported that 15% of these patients might need reintubation.[1] Although the decision to extubate the patient is considered one of the rate-limiting steps in the management of ICU patients, extubation in some units is dependable on personal experience rather than the clinical criterion, and this leads to major differences in practical aspects and duration of mechanical ventilation. The goal of extubation is to avoid the serious complications related to intubation and mechanical ventilation as pneumonia. On the other hand, premature extubation in critical patients may lead to reintubate in more than 30%.[2] Unfortunately, the incidence of death in the reintubated patients is much more than the extubated patients who are 50% and 5% respectively.[3]

The spontaneous breathing trial (SBT) is the most frequently used method to assess respiratory function recovery in mechanically ventilated patients. The Guidelines for weaning from mechanical ventilation recommend removal of the endotracheal tube if the patient has passed a spontaneous breathing trial.[4,5,6]

Nevertheless, 12.4–21% of patients require reintubation within 48–72 h, although they have a successful SBT.[7,8] Which is due to many reasons, such as large amount of secretions, advanced age, weak cough, impaired neurological status, or laryngospasm. Avoiding reintubation is crucial as reintubation is associated with an almost 5-fold increase in the relative odds of death and a 2-fold increase in median ICU and hospital stay.[9]

The strength of a cough in addition to the presence of secretions are the two major predictors of successful extubation during weaning off the mechanical ventilation.[10,11] On the other hand, the recognition of the exact predictors of decannulation outcome may help in decreasing the intubation time and enhance the clinical decision to decannulate patients which reduces the risk of infection associated with the prolonged incubation.[12]

Reintubation could be anticipated by evaluating the CPF before extubation.[13] CPF in intubated patients is recorded using a spirometer which may be not found in

many ICU's. Recently it was suggested by Whitemore et al. to use the cough strength score, graded from 0 to 5 where five is considered the most potent for anticipating the reintubation after planned extubation. And results showed that patients with low CSS had more chance of reintubation.[14]

The objective of this study is to evaluate between cough strength score (CSS) and cough peak flow (CPF) and answer the question asking about considering CSS accurate as CPF in anticipating reintubation.

2. METHODS

A prospective, randomized and double-blind investigation included 204 patients who were candidates for weaning off intermittent ventilation and extubation after a successful spontaneous breathing test was carried out. This study was conducted in the intensive care unit of Jinnah hospital, Lahore within the period of June 2015 to October 2017. Ethical Committee Approval was obtained.

A Ramsay score of 3 - 4 was sustained if agitation or patient-ventilator asynchrony occurred. Sedation was stopped every morning if the patient was quiet, and if not, the sedation was resumed. Every morning, patients were assessed for readiness to be weaned off mechanical ventilation. After an optimum spontaneous breathing test, the endotracheal tube was removed. Before extubation, the patients were positioned at angles of 30° to 45°, and then the CSS was firstly recorded followed by CPF. In order to record CSS patients coughed with as much effort as possible after disconnecting the ventilator. Cough strength was scored from 0 to 5 according to the obtained patient response, where zero is equivalent to the case of no cough on command, one is given in the case of audible movement of air via the endotracheal tube but no audible cough, two represents the weakly (barely) audible cough, three is the clearly audible cough, four is the stronger cough, and finally five is given to the multiple sequential strong coughs.[14] Recording CPF was by using a Spirometer that is connected to the endotracheal tube. Before starting recording secretions were cleared by suctioning, and patients were oxygenated with pure oxygen for three minutes. Then the ventilator was disconnected, and the spirometer was connected to the endotracheal tube, and the patient was asked to cough with as much effort as possible. The highest CPF was recorded from 3 recordings. Reintubation was required if patients demonstrated tachypnea, hypoxemia, hypercapnia, hemodynamic instability, reduced consciousness, diaphoresis, or clinical signs of respiratory muscle fatigue. Reintubation was recorded during three days after extubation.

Statistical analysis was performed using the analysis of variance method (ANOVA). The Pearson correlation coefficient was used to evaluate the association between CSS and CPF Data is represented as the mean ± standard deviation (SD). A value of $P < 0.05$ was considered statistically significant.

3. RESULTS

The demographic data of patients is demonstrated in Table 1. The reintubation incidence was 18% (37 patients) during three days after scheduled extubation. The pre-extubation data after a spontaneous breathing test is shown in Table 2. The successfully extubated patients experienced more CPF (68.2 ± 32.2) L/min compared to the reintubated group (46.1 ±20.2) L/min, and more CSS (2.9 ± 1.5) compared to (1.6 ± 1.4) respectively. The obtained results were of a significant difference since the P value was less than 0.05, while the diagnostic precision of CSS was not different from that of CPF.

The results in Table 3 showed that CSS increased continuously as CPF increased, where CSS demonstrated a potent positive association with CPF P <0.05. The reintubation incidence increased as the CSS reduced. Patients with CSS grades of 4, 3, 2, 1, a CSS grade of 5 during three days after scheduled and 0 were respectively of 2.9, 3.7, 4.1, 5.8, and 6.9 extubation Table 4. times as likely to be reintubated as were patients with.

Table (1): Demographic data of patients.

Parameter	Extubation n=167	Reintubation n=37	P
Age(years)	74.7 ± 16	75.5 ± 15	>0.05
Gender (No): M F	 104 63	 20 17	 >0.05
Causes of intubation (No): COPD Pneumonia ARDS Postop. Respiratory Failure	 82 51 20 14	 15 13 4 5	 >0.05 >0.05 >0.05 >0.05
Duration of intermittent ventilation pre- extubation (Days)	7.3 ± 6.2	7.2 ± 5.5	>0.05

Table (2): Clinical data of patients after spontaneous breathing test.

Parameter	Extubation N=167	Reintubation N=37	P
Resp.rate(/min)	18±5	18 ± 4	>0.05
Heart rate(B/min)	87 ± 8	89 ±9	>0.05
PH	7.39 ± 0.41	7.35 ± 0.25	>0.05
PaCO2,mmHg	44 ± 9	46 ±11	>0.05
PaO2,mmHg	88 ± 18	91 ± 22	>0.05
Fraction of inspired O2(Fio2)	0.39 ± 0.04	0.40 ± 0.03	<0.05
Cough peak flow, L/min	68.2 ± 32.2	46.1 ± 20.2	<0.05
Cough strength score	2.9 ± 1.5	1.6 ± 1.4	<0.05

Table (3): Correlation between CSS and CPF.

CSS	0	1	2	3	4	5
CPF	33.1 ±9.2	34.4 ± 8.4	39.2 ± 15.1	52.6 ± 17.6	71.9 ± 27.3	106.8 ± 29.3

Table (4): Reintubation incidence in CSSs.

CSS	TOTAL NO.	NO, %	RISK
5	52	3(5.8)	0.9(0.08-1.1)
4	41	6(14.6)	2.9(1.2-9.3)
3	34	6(17.6)	3.7(1.7-11.3)
2	34	8(23.5)	4.1(2.1-16.4)
1	23	7(30)	5.8(3.2-21.5)
0	20	7(35)	6.9(4.3-27.1)

4. DISCUSSION

Extubation failure is defined as the inability to maintain a spontaneous breathing after removal of the artificial airway, while the reintubation is restricted to be during a specified time within 24-72h or up to 7 days. The recognition of the anticipators of reintubation is of vital importance for health providers. CPF is considered an independent anticipator of reintubation. It had been shown that patients with failed extubation had remarkably fewer CPFs than patients with successful extubation. 60 L/min was considered the optimal threshold obtained in anticipating extubation failure at 72 hours after extubation. Our optimal cutoff point achieved in this study is comparable to that found previously by Salturk and Esquinas.[15]

CSS was initially introduced in 2001.[14] The previous investigation enrolled 91 patients with 100 extubations. Patients with scores 0 to 2 which are considered weak coughs were four times more to have unsuccessful extubation, compared with patients with moderate to strong coughs graded from 3 to 5 (risk ratio, 4.0; 95% CI, 1.8–8.9) at three days after extubation.[14] Reintubation is correlated with cough strength. Patients with CSS of 0 - 4 had a higher risk compared with those of CSS of 5, and they have 2.9 to 6.9 times more risk for reintubation. There is almost 30% incidence of reintubation in patients with 0 score. And caution must be taken in patients with low CSS. If extubation is performed, these patients must have enhanced airway management such as chest physio- therapy, administration of expectorant drugs, and optimum humidification.

The CPF is a measurement of cough strength, and it has a high correlation with reintubation after scheduled extubation.[16] The sensitivity and specificity of CSS for anticipating the reintubation were comparable to those for CPF.[17] Results showed that the CSS had a strong positive association with CPF. Recording of CPF in intubated patients needs a spirometer with a bacterial filter to avoid crosscontamination, and a connector piece to be connected to the endotracheal tube. In contrast to CSS which is a scale graded from 0 to 5 and does not need any instrument. So CSS is applicable and can be performed easily by health providers to evaluate cough strength. Patients with chronic obstructive lung disease are considered to be the most difficult to wean with extubation and with 35 – 67% incidence of failure.[15]

Mechanical ventilation period post failed extubation increases in both ICU admission and hospital expenses, and there should be caution in administrating sedative and analgesics before extubations since there is a higher incidence of reintubation. And as CSS is a semi-quantitative recording and optimal recording requires the clinician's expertise and needs frequent training.

5. CONCLUSION

CSS, if suitably recorded by clinicians, has a high association with CPF and has good sensitivity and specificity for anticipating extubation failure. As a noninvasive recording, CSS could be considered as precise as CPF for anticipating reintubation after scheduled extubation.

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