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Effectiveness of Noninvasive Ventilation in Acute Respiratory Failure

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Abstract

Background: Primary advantage of NIV is the prevention of complications from invasive ventilation, the acute first disorders treated with NIV were exacerbation of COPD and ALE and over the last 20 years the use of it has been extended to patients with hypoxemic RF.

Aim of Study: Was to determine the effectiveness of NIV, the factors predicting failure of it in ARF.

Patients and Methods: This study was prospective observational study on 60 patients with acute respiratory failure which were divided into 3 groups, Group A included 20 patients with ARF type II due to COPD exacerbation, Group B included 20 patients with ARF due to acute lung edema in patients with acute or chronic heart failure and Group C included 20 patients with ARF due to pulmonary causes other than ACPE. NIV applied and complete clinical examination including: Vital signs, (GCS) scale and APACHE II score assessment were done at first. (ABG) the first was at the admission to ICU and the second ABG after 2 hours from the start of NIV.

Results: Regarding the fate of NIV either the success or failure it was found that the total percent of patients in which the NIV successed was 68.33% and the total percent of patients in which the NIV failed was 3 1.67%, group C show the higher percentage of failure of NIV (60%). Logistic regression was assessed at the start of NIV to elucidate parameters that had relation to failure at the start showed that GCS was the parameter most closely related to failure followed by APACHEII score then type of the respiratory failure of the studied groups, Logistic regression was assessed for the change of ABG parameters & vital signs at the start after 2 hours from NIV to elucidate parameters that had relation to failure found that the change in HR was the parameter most closely related to failure followed by the change in RR and the change in temperature then the change in PaO_2.

Conclusion: The type of acute respiratory failure is independent risk factor for failure of NIV so, NIV is an effective modality with hypercapnic RF due to exacerbation of COPD and cardiogenic pulmonary edema and can avoid the endotracheal intubation, the use of it in hypoxemic RF should be assessed on an individualized basis but the key factor in deciding the use of NIV is the probability of failure which can worsen the prognosis of patients regardless the type of ARF and our results had identified several independent predictors of failure as the GCS and the APACHEII score at the start of NIV, the change of respiratory rate, heart rate and PO_2 level from baseline to the second hour from its suspension

Key Words: *Respiratory failure – Noninvasive ventilation – Positive pressure ventilation – Predictors of failure and success of NIV.*

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Introduction

RESPIRATORY failure is a syndrome in which the respiratory system fails in one or both of its gas exchange functions: Oxygenation and carbon dioxide elimination. In practice, it may be classified as either hypoxemic (Type I) or hypercapnic (Type II), respiratory failure may be further classified as either acute or chronic. Although acute respiratory failure is characterized by life-threatening derangements in arterial blood gases and acid-base status, the manifestations of chronic respiratory failure are less dramatic and may not be as readily apparent **[1,2]**.

The first line of treatment of patients with acute respiratory failure (ARF) is mechanical ventilation; patients with ARF can be ventilated either invasively or nomnvasively. NIV is the provision of the ventilatory support of positive pressure to the lungs without the use of a tracheal prosthesis through the upper airway using interfaces **[3-5]**. The primary advantage is the prevention of complications from invasive ventilation, such as the aspiration of gastric contents, oropharynx trauma, ventilator-associated pneumonia (VAP), tracheal stenosis and pneumothorax **[6]**.

The most discussed NIV methods include continuous positive airway pressure (CPAP), which uses a single pressure level during both phases of the respiratory cycle, and ventilation with two levels of pressure which named bi-level positive

airway pressure (BIPAP), which uses an inspiratory positive airway pressure (IPAP) and an expiratory positive airway pressure (EPAP) [7].

Aim of the study:

The aim of this study was to determine the effectiveness of noninvasive positive pressure ventilation (NIPPV), the factors predicting failure of it in acute respiratory failure (ARF).

Patients and Methods

This study was prospective observational study, carried out in Chest Department and Cardiology Department, Faculty of Medicine, Tanta University Hospitals on 60 patients with acute respiratory failure of either hypercapnic or hypoxemic types, the duration of the study started from July 2016 to March 2017 when target number of patients had been reached.

The patients were divided into 3 groups:

- *Group A:* It included 20 patients with acute respiratory failure type II due to COPD exacerbation.
- *Group B:* It included 20 patients with acute respiratory failure due to acute lung edema in patients with acute or chronic heart failure.
- *Group C:* It included 20 patients with acute respiratory failure due to pulmonary causes other than acute cardiogenic pulmonary edema.

Noninvasive mechanical ventilation applied using face masks to the patient with continuous flow oxygen to achieve saturation of peripheral oxygen (SaO_2) of 90%–92%.

All patients were subjected to full history taking from patients and their relatives, Complete clinical examination including: Vital signs (systolic blood pressure, diastolic blood pressure, respiratory rate, heart rate and temperature) and Glasgow Coma Scale (GCS), arterial blood gases (ABG) showing (PH, PaO_2, $PaCO_2$, and HCO_3) the first was at the admission to ICU and the second ABG after 2 hours from the start of NIV then the follow-up by ABG till recovery and weaning from NIV, Clinical investigations as complete blood count (CBC), liver function tests, blood urea and serum creatinine, sodium and potassium), Portable chest X-ray, ECG, ECHO evaluation of cardiac patients and assessment of all patients by APACHE II score (Acute Physiology and Chronic Health Evaluation II) is one of several ICU scoring systems. It was applied within 24 hours of admission of a patient to ICU, score from 0 to 71 (higher scores correspond to more sever disease and a higher risk of death). Score points were calculated from a patient's age and 12 routine physiological measurements: (PaO_2, temperature, mean arterial pressure, PH arterial, heart rate, respiratory rate, serum sodium serum potassium, creatinine, hematocrit value, white blood cell count and Glasgow Coma Scale).

The vital signs and blood gas parameters recorded at the start and 2h after the start of NIMV, while the biochemical and hematological parameters recorded only at the start.

We reassessed the patient after 2 hours from application of NIMV to analyze the factors predicting failure of NIMV. Follow-up of the patients who had been successfully managed by NIMV till recovery was important.

Inclusion criteria:

All patients had acute respiratory failure due to acute exacerbation Of COPD (hypercapnic RF), acute cardiogenic pulmonary edema and due to pulmonary causes other than ACPE.

Exclusion criteria:

- All patients with BMI over 30.
- Acute hypercapnic RF or exacerbation of chronic hypercapnic RF without COPD (Pa Co_2 >50 mmHg).
- Post extubation RF (defined as that manifesting in the 48h following extubation).
- Stable chronic patients receiving NIMV with home equipment.

Statistical analysis:

The collected data was revised, coded, tabulated and introduced to a PC using Statistical package for social science (SPSS18). Data was presented and suitable analysis was done according to the type of data obtained for each parameter. Descriptive statistics were Mean & standard deviation (±SD), for numerical data, Percentage of non-numerical data, Analytical statistics were Student T (*t*) and ANOVA test: 'Analysis of variance', Chi square test (X^2), Logistic regression that allows one to say that the presence of a risk factor increases the odds of a given outcome by a specific factor.

Results

The global mortality rate was 26.67% represented by 16 patients as the highest mortality was in group C by 50% represented by 10 patients, followed by the group A by 30% represented by 6 patients while group B show no mortality between patients of this group.

Roc curve for GCS & APACHE II in predicting failure for all patients in the three studied groups at the start of NIV showed that APACHE II cut-off was >23 with sensitivity & specificity 94.74%, 92.68% respectively followed by GCS cut-off value was < 12mmHG with sensitivity & specificity 89.47%, 82.93%.

Logistic regression was assessed at the start of NIV to elucidate parameters that had relation to failure at the start showed that GCS was the parameter most closely related to failure (p<0.001) followed by APACHEII score (p=0.002) then type of the respiratory failure of the studied groups (p=0.044). Logistic regression was assessed for the change of ABG parameters & vital signs at the start after 2 hours from NIV (the difference between them) found that the change in HR was the parameter most closely related to failure (p=0.001) followed by the change in RR (p=0.003) and the change in temperature (p=0.024) then the change in PaO_2 (p=0.043) while the change in PH, change in $PaCO_2$, change in serum HCO_3, change in SBP and the change in DBP had no significant relation to failure.

Table (1): Comparison between the three studied groups as regard the outcome of NIV.

Fate of NIV	Groups								Chi-Square	
	Group A		Group B		Group C		Total			
	N	%	N	%	N	%	N	%	X^2	p-value
Failed	7	35.00	0	0.00	12	60.00	19	31.67	16.791	<0.001 *
Successed	13	65.00	20	100.00	8	40.00	41	68.33		
Total	20	100.00	20	100.00	20	100.00	60	100.00		

Table (2): Time of failure of NIV and reasons of discontinuation of NIV and need for intubation in group A.

Group A	Time of failure	Reasons of discontinuation
(7 patients)	1 patient after 12h of NIV (14.29%)	Inability to correct dyspnea & ABG values (1patient) (14.29%)
	4 patients after 24h of NIV (57.14%)	Excessive secretions (3patients) (42.86%)
	1 patient after 48h of NIV (14.29%) 1 patient after 72h of NIV (14.29%)	Hemodynamic instability (3patients) (42.86%)

Table (3): Time of failure of NIV and reasons of discontinuation of NIV and need for intubation in group C.

Group C	Time of failure	Reasons of discontinuation
	5 patients after 2h of NIV (41.67%)	Inability to correct dyspnea and ABG values (7patients) (58.33%)
(12 patients): • 6 patients with bronchopneumonia • 3 patients with ARDS • 2 patients with bilateral pulmonary embolism • 1 patient with ILD & bronchiectasis	1 patient after 4h of NIV (8.33%) 1 patient after 6h of NIV (8.33%) 3 patients after 12h of NIV (25%) 1 patient after 48h of NIV (8.33%) 1 patient after 72 h of NIV (8.33%)	Excessive secretions (3 patients) (25%) Hemodynamic instability (2patients) (16.67%)

Table (4): Comparison between the three studied groups as regard mortality of patients in which NIV failed.

	Groups								Chi-Square	
	Group A		Group B		Group C		Total			
	N	%	N	%	N	%	N	%	X^2	*p*-value
Mortality	6	30	0	0.00	10	50.00	16	26.67	12.955	0.002*

Table (5): Baseline characteristics of studied patients and values discriminating patients in whom NIV Successed or failed.

	Fate of NIMV		*t*-test or Chi-Square	
	NIV failure (n=19)	NIV success (n=41)	*t* or X^2	*p*-value
Demographics:				
Age in years:				
Range	50–75	30–72	2.116	0.039*
Mean ±SD	62.526±8.249	56.244±11.634		
Sex:				
Male	13 68.42	26 63.41	0.143	0.705
Female	6 31.58	15 36.59		
Medical past history:				
Pre ICU NIV	0 0.00	3 7.32	1.463	0.226
Home O_2	2 10.53	7 17.07	0.436	0.509
Liver disease	7 36.84	5 12.20	4.929	0.026*
Renal disease	9 47.37	4 9.76	10.822	0.001 *
CHF	0 0.00	9 21.95	4.907	0.027*
Laboratory findings				
HV%				
Range	25–45	26–49	–1.716	0.092
Mean ±SD	34.895±5.577	37.537±5.536		
WBCS ($10^3/mm^3$):				
Range	5.6–30	3.5–20	3.003	0.004*
Mean ±SD	15.384±6.759	11.249±3.893		
Urea (mg/dl):				
Range	30–176	12–119	4.671	<0.001*
Mean ±SD	81.474±38.879	43.220±24.136		
Creatinine (mg/dl):				
Range	0.8–2.8	0.6–2.3	6.359	<0.001*
Mean ±SD	2.016±0.456	1.252±0.422		
Albumin (gm/dl):				
Range	2.7–4.1	2.5–4.2	–0.384	0.702
Mean ±SD	3.337±0.507	3.388±0.465		
Bilirubin (mg/dl):				
Range	0.7–4.4	0.4–2.8	1.014	0.315
Mean ±SD	1.153±0.822	0.980±0.488		
Sodium (mmol/L):				
Range	129–148	125–148	0.939	0.352
Mean ±SD	139.526±5.777	138.146±5.062		
Potassium (mmol/L):				
Range	3.5–6.9	2.6–5.8	1.796	0.078
Mean ±SD	4.479±1.035	4.076±0.683		
Scores of evaluation at the start:				
GCS:				
Range	10–14	11–14	–7.745	<0.001*
Mean ±SD	11.421±0.902	13.171±0.771		
APACHE II:				
Range	23–32	12–26	8.66	<0.001 *
Mean ±SD	26.895±2.622	19.390±3.323		

Table (6): Agreement (sensitivity, specificity and accuracy) for GCS & APACHE II score to predict failure of NIV for all patients in the three studied groups at the start of NIV.

At the start of NIV	Cutoff	Sens.	Spec.	PPV	NPV	Accuracy
GCS	≤ 12	89.47	82.93	70.8	94.4	90.8%
APACHE II	>23	94.74	92.68	85.7	97.4	98.1%

Table (7): Results of the logistic regression analysis identifying risk factors for NIV failure.

Change	*p*-value	Odd ratio	95.0% C.I. for odd ratio
Type of RF	0.044*	1.101	(0.902–3.616)
GCS at start	<0.001 *	0.124	(0.046–0.331)
APACHE II at start	0.002*	3.874	(1.623–9.247)
Change in PH start-2h	0.173	0.657	(0.358–1.203)
Change in $PaCO_2$ start-2h	0.458	1.009	(0.985–1.034)
Change in PaO_2 start-2h	0.043*	0.976	(0.949–1.003)
Change in HCO_3 start-2h	0.480	0.990	(0.963–1.018)
Change in SBP start-2h	0.190	1.043	(0.979–1.111)
Change in DBP start-2h	0.514	0.986	(0.944–1.029)
Change in HR start-2h	0.001*	1.193	(1.072–1.329)
Change in RR start-2h	0.003*	1.135	(1.044–1.234)
Change in start-2h Temperature	0.024*	0.480	(0.254–0.908)

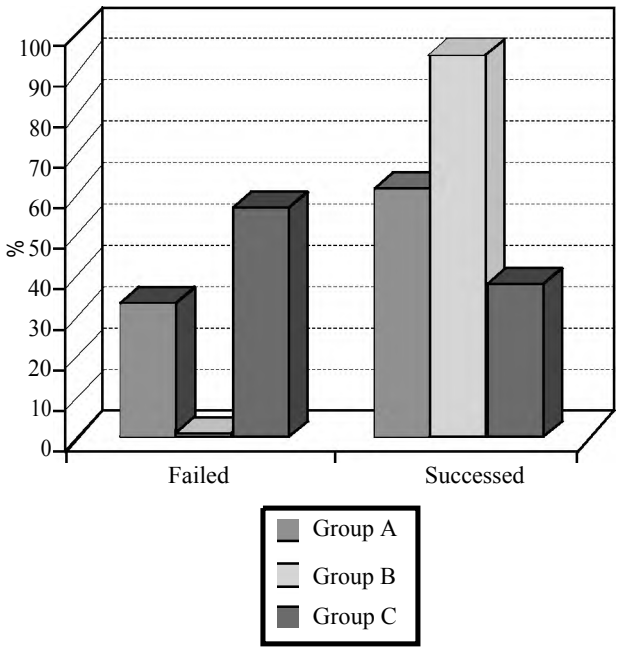

Fig. (1): Comparison between the three studied groups as regard the outcome of NIV.

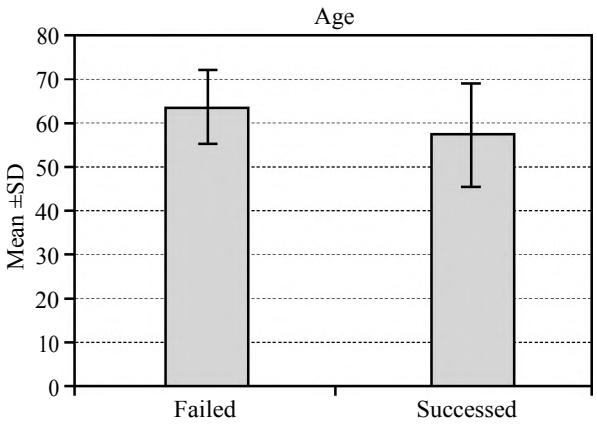

Fig. (2)

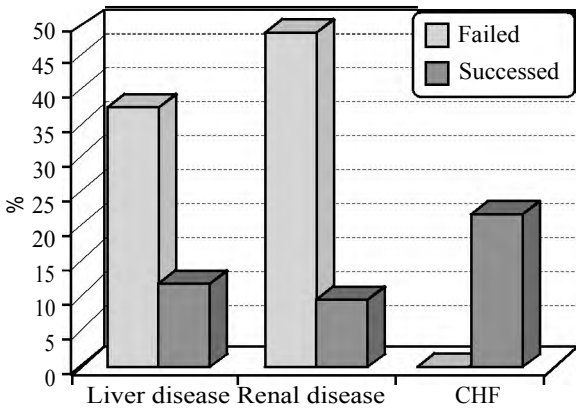

Fig. (3)

Figs. (2,3): Comparison between the failure and success groups as regard the age and past medical history.

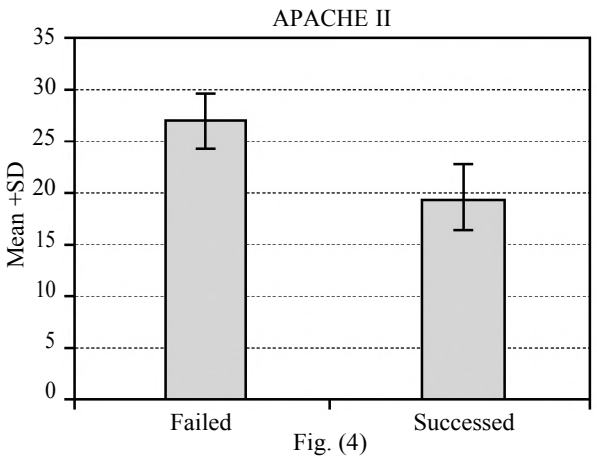

Fig. (4)

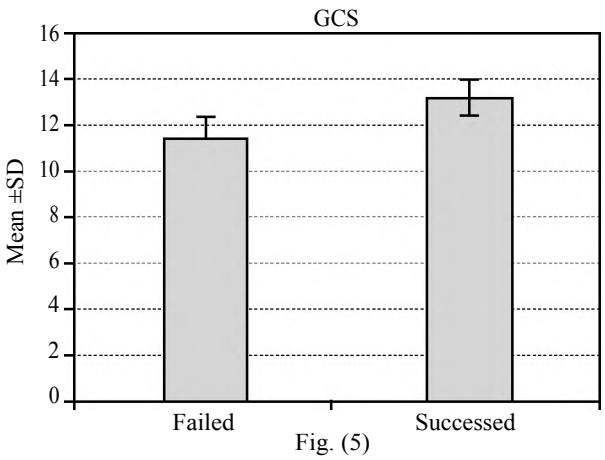

Fig. (5)

Figs. (4,5): Comparison between the failure and success groups as regard APACHEII and GCS at the start.

Discussion

In our study regarding the fate of NIV either the success or failure it was found that the total percent of patients in which the NIV successed was 68.33% represented by 41 patients from total number of patients and the total percent of patients in which the NIV failed was 31.67% represented by 19 patients and on comparing the three studied patients it was found that there was significant difference in the fate of NIV as the group B show no failure of NIV by percent of failure (0%) but while in group C show the higher percentage of failure of NIV (60%) represented by 12 patients and the group A was showed intermediate percentage of failure (35%) represented by 7 patients.

Moreover, Agarwal et al., [8] agree with our result as they showed that Overall NIPPV was successful in 71.4% with three out of 24 (12.5%) patients in the COPD group and 15 out of 39 (38.5%; pneumonia/ARDS, 12; asthma, one; post-extubation respiratory failure, two) patients in ARF due to other causes group requiring endotracheal intubation and invasive ventilation respectively, and was statistically significant.

In another study, Honrubia et al., [9] found that the failure rate was found to be between 24% and 58% the latter being the rate observed in a randomized study involving different types of RF.

In agreement with our results, Plant et al., [10], Nava et al., [11], Confalonieri et al., [12], Phua et al., [13] found that the failure rates of NIPPV can range from 5% to 50% in different studies depending on the etiology and severity of ARF.

In disagreement of our results, Schettino et al., [14] found that the NIMV failure rate was 50.7% in ARF. However, the broad range in percentage failure observed in the literature is notorious. The fundamental reason for such variability is probably the different proportions of types of RF in the different studies. It therefore might be more useful to compare results according to type of RF.

In addition many studies by Brochard et al., [15], Brochard et al., [16], Plant et al., [17]., Martin-Gonzalez et al., [18] reported that the success rate was high in exacerbations of COPD, in ALE, ranging between 70 and 78%. In the first two groups, the scientific evidence is overwhelmingly in favor of the use of NIMV.

In agreement with our results, Festic et al., [19] found that NIV is beneficial in selected patients with AHRF. The issue is the selection of the right patient who will benefit from NIV. Another important issue is the early identification of the patient who is failing NIV, so as to avoid the delay in intubation. Delays in endotracheal intubation in patients being managed with NIV have been shown to be associated with decreased survival.

In agreement with our results, Ozyilmaz et al., [20] found that in study that showed the timing of noninvasive ventilation failure the results were: The possible causes of immediate failure (within minutes to <1h) were a weak cough reflex, excessive secretions, hypercapnic encephalopathy, intolerance, agitation, and patient-ventilator asynchrony. The major potential interventions include chest physiotherapeutic techniques, early fiber optic bronchoscopy, changing ventilator settings, and judicious sedation. The risk factors for early failure (within 1 to 48h) may differ for hypercapnic and hypoxemic respiratory failure. However, most cases of early failure were due to poor arterial blood gas (ABGs) and an inability to promptly correct them, increased severity of illness, and the persistence of a high respiratory rate, despite a satisfactory initial response.

In agreement with our results, Brochard al., [16], Confalonieri et al., [21], Antonelli al., [22], Conti et al., [23] found that early NIV failure nearly 65% of NIV failures occur within 1-48h of NIV use. And Ozyilmaz et al., [20] found that this time interval had received more attention in assessments of predictors of failure.

In agreement with our results, Ozyilmaz et al., [20] found that although the definition of late NIV failure has not been standardized; it is usually defined as failure that occurs 48h after initiation of NIV, following an initial successful response. Actually, it occurs in a considerable subset of patients (about 15% of NIV failures).

In our study regarding the mortality between patients in which NIV failed in the three studied groups it was found that global mortality rate was 26.67% represented by 16 patients as the highest mortality was in group C by 50% represented by 10 patients, followed by the group A by 30% represented by 6 patients while group B show no mortality between patients of this group.

In agreement with our results, A recent single center study by Mosier et al., [24] had suggested that in patients who fail on NIV and subsequently, ventilated have poorer outcomes.

In disagreement of our results, Peter et al., [25] showed that of the 12 patients for whom NIV failed, two (4%) patients actually died while mortality rate in the previous meta-analysis study was 8%.

In accordance of our results, Ibrahim et al., [26] found that the only significant differences observed in baseline characteristics of patients who failed NIV versus those who succeeded are the mean age of the failed group was higher (70) than that in the success group (56) (p-value=0.036).

In agreement with our results, Anton et al., [27], Confalonieri et al., [12] found that patients likely to fail NPPV a lower level of consciousness on presentation.

In addition another study by Rana et al., [28] reported that other independent risk factors for NIV failure include, lower Glasgow coma score, was predictor of NIV failure.

In agreement with our results, Antonelli et al., [29] found that an important predictor of NIV failure had been the severity of the underlying illness, as assessed with the APACHE II score or similar scoring systems. Although some studies by Meduri et al., [30], Anton et al., [27] failed to demonstrate that observation.

In agreement with our results, Martin-Gonzalez et al., [18] found that the differences of general characteristics of the patients in which NIV proved successful and those in which NIV failed ,there were significant differences in the APACHE II score and the presence of some type of immunosuppression (according to the detention of the APACHE II score).

In disagreement of our results, Agarwal et al., [31] found that the baseline APACHE II score was not associated with NIV failure. A probable reason for this is the fact that the APACHE II score itself was not very high.

In contrast to our results, Ibrahim et al., [26] found that one of the significant differences observed in patients who failed NIV versus those who succeeded was the duration of ICU stay was higher in the failed group than in the success group (p-value >0.001).

In our study Roc curve for GCS & APACHE II in predicting failure for all patients in the three studied groups at the start of NIV showed that APACHE II cut-0ff was >23 with sensitivity& specificity 94.74%, 92.68% respectively followed by GCS cut-off value was ≤12mmHG with sensitivity & specificity 89.47%, 82.93%.

In agreement with our results, Anton et al., [27] found that on presentation, patients who had an Acute Physiology and Chronic Health Evaluation (APACHE II) score 29, and a Glasgow coma score 11 had failure rates ranging from 64% to 82%. Whether NPPV should be attempted in the face of these unfavorable odds remains a matter of clinical judgment.

In agreement with our results, Confalonieri et al., [12] . found that some investigators had suggested using mixed indices between hypercapnic and hypoxemic respiratory failure to improve the probability of the prediction of NIV failure. A risk stratification chart of NIV failure demonstrated that COPD patients with a Glasgow Coma Scale (GCS) <11, an APACHE II score ≥29.

In our study we found that Logistic regression was assessed at the start of NIV to elucidate parameters that had relation to failure at the start showed that GCS was the parameter most closely related to failure (p<0.001) followed by APACHEII score (p=0.002) then type of the respiratory failure of the studied groups (p=0.044).

Logistic regression was assessed for the change of ABG parameters & vital signs at the start after 2 hours from NIV (the difference between them) to elucidate parameters that had relation to failure found that the change in HR was the parameter most closely related to failure (p=0.001) followed by the change in RR (p=0.00$_3$) and the change in temperature (p=0.024) then the change in PaO_2 (p=0.043) while the change in PH, change in Pa CO_2, change in serum HCO_3, change in SBP and the change in DBP had no significant relation to failure.

In agreement with our results, Martin-Gonzalez et al., [18] found that the results of the logistic regression analysis identified the following predictors of failure: A diagnosis of pneumonia, high APACHE II score, higher respiratory frequency, GCS before NIMV, PaO_2 after 1h of NIMV and the exacerbation of COPD has been identified as a predictor of success.

In agreement with our results, Curtis et al., [32] found that the use of NPPV for reversal of hypoxemic respiratory failure was less well established than for hypercarbic respiratory failure. However, this didn't necessarily mean NPPV should not be

used. A recent systematic review and meta-analysis, which specifically excluded the use of NPPV for cardiogenic pulmonary edema or COPD, indicated a viable role for NPPV in hypoxemic respiratory failure.

Acknowledgments:

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Conflicts of interest:

No conflicts of interest declared.

Abbreviations:

ABG	: Arterial blood gases
ACPE	: Acute cardiogenic pulmonary edema
AHF	: Acute heart failure
AHRF	: Acute hypoxemic respiratory failure
ALE	: Acute lung edema
ALI	: Acute lung injury
APACHE	: Acute Physiology and Chronic Health Evaluation
APE	: Acute pulmonary edema
ARDS	: Acute respiratory distress syndrome
ARF	: Acute respiratory Adaptive servo ventilation
AVAPS	: Average volume assured pressure support
BIPAP	: Bi-level positive airway pressure
BPM	: Breaths per minute
BURR	: Backup respiratory rate
CBC	: Complete blood count
CNS	: Central nervous system
CSA	: Central sleep apnea
COPD	: Chronic obstructive pulmonary disease
CPAP	: Continuous positive airway pressure
EPAP	: Expiratory positive airway pressure
ETI	: Endotracheal intubation
ETT	: Endotracheal tube
FIO2	: Fraction of inspired oxygen
FRC	: Functional residual capacity
GCS	: Glasgow Coma Scale
GOLD	: Global Initiative for Chronic Obstructive Lung Disease
HR	: Heart rate
ICP	: Intracranial pressure
IPAP	: Inspiratory positive airway pressure
IVAPS	: Intelligent volume assured pressure support
NAVA	: Neurally adjusted ventilatory assist
NIMV	: Non-invasive mechanical ventilation
NIPPV	: Non-invasive positive pressure ventilation
NIV	: Non-invasive ventilation
OSA	: Obstructive sleep apnea
PaCO2	: Partial arterial carbon dioxide tension
PAO2	: Partial alveolar oxygen tension
PaO2	: Partial arterial oxygen tension
PEEP	: Positive end-expiratory pressure
PSV	: Pressure support ventilation
PVD	: Patient-ventilator dyssynchrony
RF	: Respiratory failure
RR	: Respiratory rate
TV	: Target volume
VAP	: Ventilator-associated pneumonia
VILI	: Ventilation-induced lung injury
VPAP	: Variable positive airway pressure
VTPV	: Volume targeted pressure ventilation

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فعالية التنفس الصناعى اللا أجتياحى فى فشل الجهاز التنفسى الحاد

الهدف من العمل: والهدف من هذا العمل I هو تحديد كفاءة التنفس اللا أجتياحى الإيجابى والعوامل التى تتنبأ بفشله فى فشل الجهاز التنفسى الحاد.

الأشخاص وطرق البحث: لقد تم عمل هذه الدراسة الرصدية فى قسم الصدر وأمراض القلب فى كلية الطب مستشفيات طنطا على ٦٠ مريضاً يعانون من الفشل التنفسى الحاد النوع الأول والثانى وقد بدأت مدة الدراسة من يوليو ٢٠١٦ إلى مارس ٢٠١٧ عندما تم الوصول إلى العدد المستهدف من المرضى.

وتم تقسيم المرضى إلى ثلاث مجموعات :

المجموعة الأولى (أ) : شملت ٢٠ من المرضى الذين يعانون من فشل الجهاز التنفسى الحاد بسبب تفاقم الأنسداد الرئوى المزمن.

المجموعة الثانية (ب) : شملت ٢٠ من المرضى الذين يعانون من فشل الجهاز التنفسى الحاد بسبب ذمة الرئة الحادة فى المرضى الذين يعانون من قصور القلب الحاد أو المزمن.

المجموعة الثالثة (ج) : شملت ٢٠ من المرضى الذين يعانون من فصل الجهاز التنفسى الحاد النوع الأول (نقص نسبة الأكسچين فى الدم الشريانى دون أرتفاع نسبة ثانى أكسيد الكربون) نتيجة لأسباب رئوية غير ذمة الرئوية الحادة القلبية.

وتم تطبيق التنفس الصناعى اللا أجتياحى بإستخدام أقنعة الوجه للمريض مع الأوكسچين المتدفق المستمرلتحقيق تشبع الأوكسچين الطرفى والوصول به إلى ٩٠-٩٢٪ .

النتائج: تم تقييم الأنحدار اللوچيستى فى بداية إستخدام التنفس الصناعى اللا أجتياحى لتوضيح المعلمات التى لها علاقة بالفشل فى البداية وأظهرت أن مقياس الجلاسكوكوما كانت المعلمة الأكثر أرتباطاً بالفشل (p<0.001) تليها مقياس أباتشى النتيجة (p=0.002) ثم نوع فشل الجهاز التفسى الحاد بين المجموعات المدروسة (p=0.044).

تم تقييم الأنحدار اللوچيستى لتغيير معلمات غازات الدم والعلامات الحيوية فى البداية وبعد ساعتين من إستخدام التنفس الصناعى اللا أجتياحى (الفرق بينهما) لتوضيح المعلمات التى لها علاقة بالفشل وجدت أن التغير فى معدل ضربات القلب كان الأكثر أرتباطاً بالفشل (p=0.001) يليه التغير فى معدل التنفس (p=0.003) والتغير فى درجة الحرارة (p=0.024) ثم التغير فى الضغط الجزئى للأوكسچين فى الدم (p=0.043) فى حين أن تغير نسبة حموضة الدم، نسبة ثانى أكسيد الكربون فى الدم، التغير فى تركيز بيكربونات الصوديوم فى الدم، ضغط الدم الأنقباضى وضغط الدم الأنبساطى ليس له علاقة ذو أهمية بالفشل.

الأستنتاج: توصلنا أن نوع الفشل التفسى الحاد هو عامل خطر مستقل لفشل التفس الصناعىاللا أجتياحى لذلك، التنفس الصناعى اللا أجتياحى هو وسيلة فعالة لعلاج فشل الجهاز التنفسى الحاد من النوع الثانى بسبب تفاقم مرض الإنسداد الرئوى المزمن والذمة الرئوية القلبية ويمكن تجنب التهوية الميكانيكية به ولكن إستخدمه فى نقص الأوكسچين نتيجة فشل الجهاز التنفسى الحاد من النوع الأول ينبغى تقييمه على أساس فردى. وأن العامل الرئيسى فى قرار إستخدام التنفس الصناعى اللا أجتياحى هو أحتمال الفشل الذى يمكن أن يؤدى إلى تفاقم المرض بغض النظر عن نوع فشل الجهاز التنفسى الحاد وقد حددت نتائجنا هدة تنبؤات مستقلة من الفشل مثل مقياس الجلاسجو ومقياس أباتشى فى البداية من إستخدام التنفس الصناعى اللا أجتياحى، وتغير معدل ضربات القلب ومعدل التنفس ومستوى الضغط الجزئى للأوكسچين فى الدم من بداية إستخدام التنفس الصناعى اللا أجتياحى إلى الساعة الثانية من إستخدمه