DIAPHRAGMATIC IMPAIRMENT AS A PREDICTOR OF INVASIVE VENTILATION IN ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE PATIENTS

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INTRODUCTION

Diaphragmatic assessment in Chronic Obstructive Pulmonary Disease (COPD) has a major clinical relevance as COPD patients have a risk of diaphragmatic dysfunction which may affect ventilatory management during acute exacerbation.
Ultrasonography is a reasonable non -invasive method for diaphragmatic assessment in acute exacerbation of COPD patients, thus the purpose of the study was to investigate impact of ultrasound assessed diaphragmatic impairment on non - invasive mechanical ventilation (NIMV) outcome in acute exacerbation.

AIM OF THE WORK

Was to determine the ability of ultrasound assessed diaphragmatic impairment to predict NIMV failure and the need of invasive mechanical ventilation in acute exacerbation of COPD.

SUBJECTS AND METHODS

Subjects:
This study was performed on seventy-five patients with acute exacerbation COPD who admitted to the critical care department units and eligible for non-invasive mechanical ventilation (NIMV)

Methods:
An observational prospective study was conducted:
The following data were recorded on admission: patient's criteria, patient's clinical parameters, laboratory parameters and arterial blood gases on admission and after NIMV.
Diaphragmatic thickness was measured on both sides before NIMV and diaphragmatic Thickness fraction was calculated, the Patients enrolled in the study were followed up for NIMV outcome, ICU stay and mortality.
Patients were categorized into two groups according to their primary outcome (NIMV success).

RESULTS

Table 1: Comparison between Successful and Failure NIV according to Thickness fraction on admission

Thickness fraction	Total (n= 75)	NIMV		U	p
		Successful(n= 45)	Failure (n= 30)		
Right					
Min. – Max.	0.11 – 0.56	0.16 – 0.56	0.11 – 0.30	65.50*	<0.001*
Mean ± SD.	0.30 ± 0.13	0.38 ± 0.10	0.18 ± 0.05		
Median (IQR)	0.30 (0.17 – 0.41)	0.39 (0.33 – 0.44)	0.17 (0.15 – 0.19)		
Left					
Min. – Max.	0.10 – 0.52	0.16 – 0.52	0.10 – 0.29	56.50*	<0.001*
Mean ± SD.	0.26 ± 0.12	0.33 ± 0.09	0.16 ± 0.05		
Median (IQR)	0.26 (0.15 – 0.35)	0.34 (0.28 – 0.41)	0.14 (0.13 – 0.16)		

IQR: Inter quartile range SD: Standard deviation U: Mann Whitney test
p: p value for comparing between the studied groups *: Statistically significant at p ≤ 0.05

Table 2: Comparison between Successful and Failure NIV according to Thickness fraction on admission

	Total (n= 75)		NIMV				Test of significance.	p
			Successful (n= 45)		Failure (n= 30)			
	No.	%	No.	%	No.	%		
Mortality								
Nonsurvivor	13	17.3	4	8.9	9	30.0	c^2= 5.599*	0.018*
Survivor	62	82.7	41	91.1	21	70.0		
ICU Stay								
Min. – Max.	7.0 – 21.0		7.0 – 16.0		10.0 – 21.0		t= 7.186*	<0.001*
Mean ± SD.	12.91 ± 3.70		10.98 ± 2.67		15.80 ± 3.10			
Median (IQR)	13.0 (10.0 – 16.0)		11.0 (9.0 – 13.0)		16.0 (14.0 – 18.0)			

IQR: Inter quartile range SD: Standard deviation χ^2: Chi square test FE: Fisher Exact
t: Student t-test p: p value for comparing between the studied groups
*: Statistically significant at p ≤ 0.05

Table 3: Validity (AUC, sensitivity, specificity) for thickness fraction to predict NIV failure (n= 30)

Thickness fraction	AUC	P	95% C.I	Cut off	Sensitivity	Specificity	PPV	NPV
Right	0.951	<0.001*	0.907 – 0.994	≤0.29	96.67	82.22	78.4	97.4
Left	0.958	<0.001*	0.920 – 0.996	≤0.26	96.67	80.0	76.3	97.3

AUC: Area Under a Curve p value: Probability value CI: Confidence Intervals
NPV: Negative predictive value PPV: Positive predictive value *: Statistically significant at p ≤ 0.05

Table 4: Validity (AUC, sensitivity, specificity) for thickness fraction to predict mortality (n= 13)

Thickness fraction	AUC	P	95% C.I	Cut off	Sensitivity	Specificity	PPV	NPV
Right	0.676	0.048*	0.552 – 0.799	≤0.27	76.92	61.29	29.4	92.7
Left	0.679	0.043*	0.557 – 0.802	≤0.28	84.62	51.61	26.8	94.1

AUC: Area Under a Curve p value: Probability value CI: Confidence Intervals
NPV: Negative predictive value PPV: Positive predictive value *: Statistically significant at p ≤ 0.05

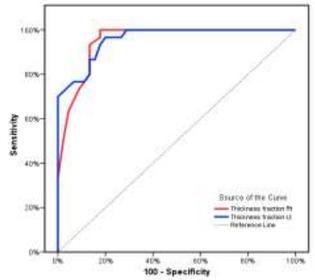

Figure 1: ROC curve for thickness fraction to predict NIV failure (n= 30)
ROC: Receiver Operating Characteristics Curve.

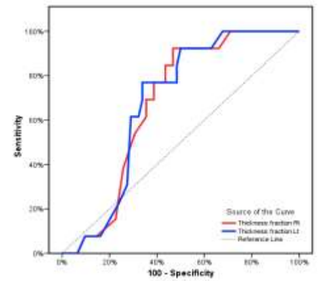

Figure 2: ROC curve for thickness fraction to predict mortality (n= 13)
ROC: Receiver Operating Characteristics Curve.

CONCLUSION

Ultrasound assessed Diaphragmatic impairment is a simple, rapid and non-invasive modality which could predict NIMV failure.