INCIDENCE OF DIAPHRAGMATIC DYSFUNCTION IN ACUTE STROKE PATIENTS ASSESSED BY ULTRASONOGRAPHY

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Introduction

Acute stroke is a leading cause of morbidity and mortality worldwide, often complicated by respiratory dysfunction. diaphragm, a key respiratory muscle, plays a critical role in maintaining adequate ventilation.

Diaphragmatic dysfunction (DD) has been increasingly recognized as a significant complication in critically ill patients, including those with stroke, but its incidence and clinical impact remain poorly understood.

Ultrasonography has emerged as a non-invasive, radiation-free tool for assessing diaphragmatic structure and function. Recent studies have demonstrated its utility in quantifying diaphragmatic contractile activity through measurements of diaphragmatic thickness and thickness fraction (TF). However, limited data exist on the role of ultrasonography in evaluating DD in acute stroke patients and its association with clinical outcomes such as mechanical ventilation needs, weaning failure, and ICU stay.

Aim of the work

1. Determine the incidence of DD in acute stroke patients using ultrasonography.
2. Evaluate the impact of DD on clinical outcomes, including mechanical ventilation duration, weaning failure, and ICU stay.
3. Assess the predictive value of diaphragmatic TF for mechanical ventilation needs.

Patients and Methods

A prospective observational study was conducted on 66 acute stroke patients admitted to the ICU. This was a prospective study to examine the incidence of diaphragmatic dysfunction in acute stroke patients was done in Critical Care Department of Alexandria University Hospitals.Patients were categorized into hemorrhagic and ischemic stroke subgroups.

The following data were collected from every patient after enrollment into the study: Demographic data: Age ,sex , past medical history, drug history. Complete physical examination. Laboratory investigations including: complete blood picture, Na, K, urea, creatinine , SGOT, SGPT , PT, PTT , INR , CK total, LDH,Serum albumin,Magnesium, calcium, phosphorus blood level, Arterial blood gases.

Radiological investigations including CT or MRI brain.

Diaphragmatic function was assessed using ultrasonography. Motility of the diaphragm will be assessed with a B-mode U/S device at the bedside connected to a 7 to 12 MHz linear probe .

Results

Table (1): Distribution of the studied cases according to diaphragmatic dysfunction (n = 66)

	Total (n = 66)	Hemorrhagic (n = 25)	Ischemic (n = 41)
	No. (%)	No. (%)	No. (%)
Normal diaphragm	29 (43.9%)	11 (44.0%)	18 (43.9%)
Right diaphragmatic dysfunction	12 (18.2%)	3 (12.0%)	9 (22.0%)
Left diaphragmatic dysfunction	20 (30.3%)	8 (32.0%)	12 (29.3%)
Bilateral diaphragmatic dysfunction	5 (7.6%)	9 (12.0%)	2 (4.9%)
Total	37 (56.1%)	14 (56.0%)	23 (56.1%)

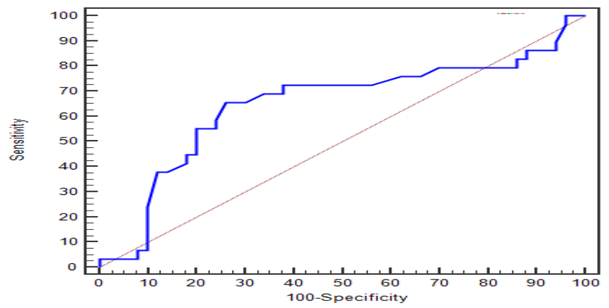

Figure (1) Graph to represent ROC curve for Thickness fraction to predict mechanical ventilation cases

Table (2):Relation between each group and different outcome parameters

	Outcome							
	Hemorrhagic (n = 25)				Ischemic (n = 41)			
	Normal diaphragm (n = 29)		Diaphragmatic Dysfunction (n = 37)		Normal diaphragm (n = 29)		Diaphragmatic Dysfunction (n = 37)	
	No.	%	No.	%	No.	%	No.	%
Mechanical ventilation								
No	10	90.9	7	50.0	13	72.2	11	47.8
Yes	1	9.1	7	50.0	5	27.8	12	52.2
$\chi 2$ (p)	$\chi 2$=4.738* (FEp=0.042*)				$\chi 2$=2.476 (p=0.116)			
Weaning failure								
Failed	0	0.0	5	13.5	4	28.6	10	71.4
$\chi 2$ (p)	4.240 (FEp=0.062)				1.704 (p=0.192)			
Successful	1	3.4	2	5.4	1	33.3	2	66.7
$\chi 2$ (FEp)	0.144 (1.000)				0.144 (1.000)			
Days of mechanical ventilation								
Mean ± SD.	0.18 ± 0.60		7.79 ± 10.39		3.67 ± 8.10		7.04 ± 9.42	
Median (Min. – Max.)	0.0 (0.0 – 2.0)		5.50 (0.0 – 30.0)		0.0 (0.0 – 30.0)		1.0 (0.0 – 30.0)	
U (p)	U=36.000* (p=0.025*)				U=155.000 (p=0.126)			
Length of ICU stay								
Mean ± SD.	11.18 ± 5.27		16.43 ± 9.44		16.11 ± 14.05		13.43 ± 6.72	
Median (Min. – Max.)	10.0 (6.0 – 22.0)		14.50 (4.0 – 30.0)		11.0 (4.0 – 60.0)		12.0 (3.0 – 30.0)	
U (p)	U=57.500 (p=0.291)				U=200.000 (p=0.853)			

Conclusion

our study demonstrates that ultrasound measurement of diaphragmatic thickness fraction is a valuable tool for predicting the need for mechanical ventilation in acute stroke patients. A cut-off value of <18% yields a sensitivity of 65.52%, specificity of 70.0%, positive predictive value (PPV) of 55.9%, and a notably higher negative predictive value (NPV) of 77.8%. Additionally, diaphragmatic ultrasound is a simple, rapid, non-invasive, and repeatable method that poses no risk to patients, making it a practical and effective option for assessing diaphragmatic function in critically ill populations.