Original Research Paper

Volume - 12 | Issue - 05 | May - 2022 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Emergency Medicine

EFFECTIVENESS OF COVID-19 SCORE

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ABSTRACT COVID-19 pandemic has affected all the countries since 2019. New variants are emerging from different countries creating wave after wave and affecting mankind to varying extent. The COVID-19 scoring system developed by Khandelwal et al consists of five parameters and a total score of 19. The parameters are Consciousness, Oxygenation, Vital Capacity, Inotropic support and Damage to the lungs on CT scan or X-rays.

In this article, we discussed treatment given based on age, gender, consciousness, oxygenation, Vital capacity, inotropic support given and damage to lungs as evident from X-rays or CT scans.

We observed that as the score increases, the chance of requirement of tracheal intubation increases. The effectiveness of this scoring system needs to be assessed on large scale. The present study can reinforce the present scoring system for some parameters where p value of <0.05 is considered statistically significant.

KEYWORDS :

INTRODUCTION:

In December 2019, the world witnessed a novel corona virus SARS-CoV-2; formerly called 2019-nCoV) causing severe acute respiratory (COVID-19) after the outbreak of pneumonia in Wuhan, a city in Hubei Province of China[1]. By the mid April 2020, COVID-19 disease was characterised as pandemic by World Health Organisation[2] (WHO) spreading to more than 210 countries[3]. This pandemic has created a huge challenge to all humanities including Health care workers and Governments to reduce the spread of the disease and also to minimize the mortality and morbidity arising out of it. The increasing demands of tracheal intubation and mechanical ventilation in the affected patients expose health care workers to aerosol transmission[4].

The "COVID-19 Score" is prepared using bed side clinical parameters especially based on airway, breathing, circulation and neurological status along with one radiological modality for assessment of the degree of damage to lungs[4]. These parameters are routinely taken into consideration for deciding the need for tracheal intubation in any critical patient[4]. This COVID-19 Scoring system proposed by Khandelwal et al[4] consists of five parameters and total score of 19. This seems to be a simple scoring system without any sophisticated investigations. This is also quick and easy to use in all types of COVID patients. "COVID-19 Score" will help to anticipate the need for tracheal intubation in critical COVID-19 patients.

	Parameters	Responses	Score
C	Consciousness	Alert and obeying commands	1
		Drowsy but responsive to verbal commands	2
		Drowsy and responsive to painful stimuli	3
		Unresponsive	4
O	Oxygenation	SpO2 ≥ 92% on room air	1
		SpO2 ≥ 88% to < 92% on room air	2
		SpO2 ≥ 88% with O2 supplementation	3
		SpO2 < 88% despite O2 supplementation	4
V	Vital Capacity (Breath Holding Time)	≥25 Sec (3500 ml VC)	1
		20–25 Secs (3000 ml VC)	2
		15–20 Secs (2500 ml VC)	3
		< 15 Secs (< 2500 ml VC)	4
I	Inotropic Support	No support	1
		Single inotrope (low dose)	2
		Single inotrope (moderate dose)	3
		Single inotrope (high dose) or > 1 inotrope	4
D	Damage to Lungs (X-Ray/CT Scan of Chest)	None to minimal damage	1
		Moderate damage	2
		Severe damage	3
19	Total Score		19

The present study was performed to evaluate the effectiveness of the proposed COVID-19 Score in the patients admitted during the second wave of COVID-19 in India during summer of 2021.

MATERIAL AND METHODS:

The present study was conducted on 200 confirmed cases of COVID-19 out of which 148 were males and 52 were females. This study was conducted during March to July 2021 over a period of five months in our affiliated Acharya Vinoba Bhave Rural Hospital which was a dedicated COVID Hospital.

The collected data was arranged systematically. Statistical analysis was done using the SPSS software. p values were calculated for various parameters and their statistical significance was noted.

RESULTS:

1. Treatment given based on gender:

The various treatment modalities given to COVID-19 patients like O2 mask, NRBM, NIV and intubation were compared in the both genders (148 males and 52 females). Table 1 shows distribution of treatment given based on gender. O2 Mask, NRBM, NIV and intubation was done in 20 (10.0%), 16 (8.0%), 88 (44.0%) and 24 (12.0%) males as opposed to 4 (2.0%), 16 (8.0%), 24 (12.0%) and 8 (4.0%) females respectively and the difference was found to be statistically significant (χ^2=11.900, p=0.008*).

Table 1: Distribution of treatment given based on gender:

Treatment		Males	Females	Total
O_2 Mask	**N**	20	4	**24**
	%	10.0%	2.0%	**12.0%**
NRBM	**N**	16	16	**32**
	%	8.0%	8.0%	**16.0%**
NIV	**N**	88	24	**112**
	%	44.0%	12.0%	**56.0%**
Intubation	**N**	24	8	**32**
	%	12.0%	4.0%	**16.0%**
Total	**N**	**148**	**52**	**200**
	%	**74.0%**	**26.0%**	**100.0%**
χ^2=11.900 , p=0.008*				

* p<0.05 – statistically significant

2. Treatment given based on the age:

Treatment given to COVID-19 patients depending on their age, 34 patients were below 45 years and 166 patients were above 45 years. Table 2 shows distribution of treatment given based on age. O2 Mask, NRBM, NIV and intubation was done in 0 (0.0%), 10 (5.0%), 20 (10.0%) and 4 (2.0%) patients below the age of 45 years opposed to among 24 (12.0%), 22 (11.0%), 92 (46.0%) and 28 (14.0%) patients above 45 years of age respectively and the difference was found to be statistically significant (χ^2=10.038 , p=0.018*).

Table 2: Distribution of treatment given based on age:

Treatment		Age below 45 years	Age More than 45 years	Total
O_2 Mask	**N**	0	24	**24**
	%	0.0%	12.0%	**12.0%**

NRBM	**N**	10	22	**32**
	%	5.0%	11.0%	**16.0%**
NIV	**N**	20	92	**112**
	%	10.0%	46.0%	**56.0%**
Intubation	**N**	4	28	**32**
	%	2.0%	14.0%	**16.0%**
Total	**N**	**34**	**166**	**200**
	%	**17.0%**	**83.0%**	**100.0%**
χ^2=10.038 , p=0.018*				

* p<0.05 – statistically significant

3. **Treatment given based on responses to parameter- Consciousness:** Table 3 shows distribution of treatment given based on responses to parameter Consciousness. O2 Mask were given in 8 (4.0%) and 16 (8.0%) patients who were alert and obeying commands and drowsy but responsive to verbal commands respectively. NRBM was done among 4 (2.0%) and 28 (14.0%) patients who were alert and obeying commands and drowsy but responsive to verbal commands respectively. NIV was done among 8 (4.0%), 23 (11.5%) and 81 (40.5%) patients who were alert and obeying commands, drowsy but responsive to verbal commands and drowsy and responsive to painful stimuli respectively. Intubation was done in 4 (2.0%) and 28 (14.0%) patients who were drowsy and responsive to painful stimuli and unresponsive respectively. The difference among the groups was found to be statistically highly significant (χ^2=270.468 , p=0.000**).

Table 3: Distribution of treatment given based on responses to parameter Consciousness:

Treatment		Alert and obeying commands	Drowsy but responsive to verbal commands	Drowsy and responsive to painful stimuli	Unresponsive	Total
O_2 Mask	**n**	8	16	0	0	**24**
	%	4.0%	8.0%	0.0%	0.0%	**12.0%**
NRBM	**n**	4	28	0	0	**32**
	%	2.0%	14.0%	0.0%	0.0%	**16.0%**
NIV	**n**	8	23	81	0	**112**
	%	4.0%	11.5%	40.5%	0.0%	**56.0%**
Intubation	**n**	0	0	4	28	**32**
	%	0.0%	0.0%	2.0%	14.0%	**16.0%**
Total	**n**	**20**	**67**	**85**	**28**	**200**
	%	**10.0%**	**33.5%**	**42.5%**	**14.0%**	**100.0%**
χ^2=270.468 , p=0.000**						

**p<0.001 – statistically highly significant

4. Treatment given based on responses to parameter - oxygenation: Table 4 shows distribution of treatment given based on responses to parameter oxygenation. O2 Mask were given in 4 (2.0%) patients with SpO2≥92% on room air and 20 (10.0%) with SpO2≥ 88%-<92% on room air. NRBM was done among 20 (10.0%) and 12 (6.0%) patients with SpO2≥ 88%-<92% on room air and SpO2≥ 88% on supplementation respectively.NIV was done among 8 (4.0%), 64 (32.0%) and 40 (20.0%) patients with SpO2≥ 88%-<92% on room air, SpO2≥ 88% on supplementation and SpO2< 88% despite supplementation respectively. Intubation was done in 4 (2.0%) and 28 (14.0%) patients with SpO2≥ 88% on supplementation and SpO2< 88% despite supplementation respectively. The difference among the groups was found to be statistically highly significant (χ^2=175.246, p=0.000*).

Table 4: Distribution of treatment given based on responses to parameter oxygenation:

Treatment		SpO_2≥92 % on room air	SpO_2≥ 88%-<92% on room air	SpO_2≥ 88% on supplementation	SpO_2< 88% despite supplementation	Total
O_2 Mask	**n**	4	20	0	0	**24**
	%	2.0%	10.0%	0.0%	0.0%	**12.0%**
NRBM	**n**	0	20	12	0	**32**
	%	0.0%	10.0%	6.0%	0.0%	**16.0%**
NIV	**n**	0	8	64	40	**112**
	%	0.0%	4.0%	32.0%	20.0%	**56.0%**
Intubation	**n**	0	0	4	28	**32**
	%	0.0%	0.0%	2.0%	14.0%	**16.0%**
Total	**n**	**20**	**67**	**85**	**28**	**200**
	%	**10.0%**	**33.5%**	**42.5%**	**14.0%**	**100.0%**
χ^2=175.246 , p=0.000*						

**p<0.001 – statistically highly significant

5. Treatment given based on responses to parameter - Vital capacity:

Table 5: Distribution of treatment given based on responses to parameter Vital capacity:

Treatment		≥ 25 sec (3500ml VC)	20-25 sec (3000ml VC)	15-20 sec (2500 ml VC)	< 15 sec (< 2500 ml VC)	Total
O_2 Mask	**n**	20	4	0	0	**24**
	%	10.0%	2.0%	0.0%	0.0%	**12.0%**
NRBM	**n**	0	20	12	0	**32**
	%	0.0%	10.0%	6.0%	0.0%	**16.0%**
NIV	**n**	0	16	60	36	**112**
	%	0.0%	8.0%	30.0%	18.0%	**56.0%**
Intubation	**n**	0	0	0	32	**32**
	%	0.0%	0.0%	0.0%	16.0%	**16.0%**
Total	**n**	**20**	**40**	**72**	**68**	**200**
	%	**10.0%**	**20.0%**	**36.0%**	**34.0%**	**100.0%**
χ^2=273.866 , p=0.000**						

**p<0.001 – statistically highly significant

Table 5 shows distribution of treatment given based on responses to parameter Vital capacity. O2 Mask were given in 20 (10.0%) and 4 (2.0%) patients with ≥ 25 sec (3500ml VC) and 20-25 sec (3000ml VC) respectively. NRBM was done among 20 (10.0%) and 12 (6.0%) patients with 20-25 sec (3000ml VC) and 15-20 sec (2500 ml VC)respectively. NIV was done among 16 (8.0%), 60 (30.0%) and 36 (18.0%) patients with 20-25 sec (3000ml VC), 15-20 sec (2500 ml VC) and < 15 sec(< 2500 ml VC)respectively. Intubation was done in 32 (16.0%) patients with < 15 sec (< 2500 ml VC). The difference among the groups was found to be statistically highly significant (χ^2=273.866 , p=0.000**).

6. Treatment given based on responses to parameter Inotropic support:

Table 6: Distribution of treatment given based on responses to parameter Inotropic support:

Treatment		No support	Single inotrope (Low dose)	Single inotrope (moderate dose)	Single inotrope (High dose) or >1 inotrope	Total
O_2 Mask	**n**	24	0	0	0	**24**
	%	12.0%	0.0%	0.0%	0%	**12.0%**
NRBM	**n**	32	0	0	0	**32**
	%	16.0%	0.0%	0.0%	0%	**16.0%**
NIV	**n**	49	47	16	0	**112**
	%	24.5%	23.5%	8.0%	0%	**56.0%**
Intubation	**n**	1	15	16	0	**32**
	%	0.5%	7.5%	8.0%	0%	**16.0%**
Total	**n**	**106**	**62**	**32**	**0**	**200**
	%	**53.0%**	**31.0%**	**16.0%**	**0%**	**100.0%**
χ^2=96.758 , p=0.000**						

**p<0.001 – statistically highly significant

Table 6 shows distribution of treatment given based on responses to parameter Inotropic support. O2 Mask and NRBM were given in 24 (12.0%) and 32 (16.0%)patients respectively with no inotropic support. was done among. NIV was done among 49 (24.5%), 47 (23.5%) and 16 (8.0%) with No support, Single inotrope(Low dose) and Single inotrope (moderate dose) respectively. Intubation was done in1 (0.5%), 15 (7.5%) and 16 (8.0%) patients with No support, Single inotrope(Low dose) and Single inotrope (moderate dose) respectively. The difference among the groups was found to be statistically highly significant (χ^2=96.758 , p=0.000**).

7. Treatment given based on responses to parameter damage to Lungs (X-ray or CT scan of Chest):

Table 7: Distribution of treatment given based on responses to parameter damage to Lungs:

Treatment		No to minimal damage	Moderate damage	Severe damage	Total
O_2 Mask	**n**	12	12	0	**24**
	%	6.0%	6.0%	0.0%	**12.0%**
NRBM	**n**	5	27	0	**32**
	%	2.5%	13.5%	0.0%	**16.0%**
NIV	**n**	0	33	79	**112**
	%	0.0%	16.5%	39.5%	**56.0%**
Intubation	**n**	0	0	32	**32**
	%	0.0%	0.0%	16.0%	**16.0%**
Total	**n**	**17**	**72**	**111**	**200**
	%	**8.5%**	**36.0%**	**55.5%**	**100.0%**
χ^2=144.796 , p=0.000**					

**p<0.001 – statistically highly significant

Table 7 shows distribution of treatment given based on responses to parameter damage to Lungs. O2 Maskwere given in 12 (6.0%) patients each with no to minimal damage and moderate damage. NRBM was done in 5 (2.5%) and 27 (13.5%) patients with no to minimal damage and moderate damage.NIV was done among 33 (16.5%) and 79 (39.5%) patients with moderate damage and Severe damage respectively. Intubation was done in 32 (16.0%) patients with severe damage. The difference among the groups was found to be statistically highly significant (χ^2=144.796 , p=0.000**).

8. Treatment given with COVID-19 score and age:

Table 8 shows correlation of treatment given with COVID-19 score and age. The Pearson's correlation coefficient revealed significant positive linear correlations between treatment and COVID-19 score (r = 0.893, p < 0.01). Weak positive linear correlation was found between treatment and age and was not statistically significant (r = 0.106, p =0.135).

Table 8: Correlation of treatment given with COVID-19 score and age:

Variable		Correlation coefficient	p value
Treatment	COVID-19 score	0.893*	<0.01
	Age	0.106	0.135

*Correlation significant at 0.01 levels (2 tailed).

DISCUSSION:

COVID-19 emerged as one of the dreaded diseases that affected the mankind noted in the history. The progression of the disease and the changing variants of the causative virus make the condition more serious. This disease characterized by huge release of inflammatory mediators which is called as cytokine storm) in critically severe COVID-19 patients, which further cause rapid deteioration of respiratory functions of the patients[5]. A recent study conducted in Italy by Grasseli G et al postulated that about 88% of critically ill patients who required respiratory support also needed tracheal intubation and mechanical ventilation[4, 6]. The prediction of likelihood of tracheal intubation in critically ill patients using scoring system labeled as "COVID-19 Score" will be helpful for appropriate execution and timely intervention.

The various modalities of treatment given to COVID-19 patients like O2 mask, NRBM, NIV and intubation to males were 74% and 26% in female patients. This suggests males needed more treatment modalities than females while combating the COVID-19. This may be attributed to stronger immune system in females which was the forefront in their defence system. UK Research and Innovation[7] also quoted that men have higher risk of severe illness and death due to COVID-19. It is postulated that X-chromosome is known to contain large number of immune-related genes in the whole genome[8]. Females having XX genotype have a double copy of key immune genes in contrast to the single copy in XY genotypic men. The same genotypisity and immunogenicity extends not only to the innate response but also to the more specific response to microbes including antibody formation (adaptive immunity)[9]. Thus women's immune systems are generally more responsive to infections and COVID-19 is no more exception. Review article by Kopel J et al[10] mentioned many studies with male predominance in acquiring the infections. Chen T et al[11] in the Tongji Hospital in Wuhan, China observed affected males in 73% of patients in 799 patients study. They proposed that the higher fatality rate in men is possibly due to an increased prevalence of cardiopulmonary disease and smoking[11]. Another theory[7] is tobacco smoking which is more prevalent in males. Vardavas CI and Nikitara K[12] mentioned that smokers have 1.4 times more chances of developing severe symptoms of COVID-19 than non smokers[7].

The different treatment modalities were much more needed in COVID-19 patients above the age of 45 years (83% vs 17%) in the present study. Jakhmola S, Baral B and Jha HC[13] (2021) pointed out that population groups of 20-49 years of age and 50 years-above were highly vulnerable to infection. They reported that most commonly affected age group was 20-49 years in India but most deaths were reported from the age group 50 years and above worldwide.

Bauer, P et al[14] in their descriptive analysis mentioned that age dependency is stronger for COVID-19 mortality. They further quote that exponential increase of COVID-19-related mortality exists with age[14]. Union health ministry of Govt. of India clarified that about 88% of all Covid-19 deaths in the country are in the age group of 45 years and above[15].

In the present study, 40.5% patients who were drowsy but responsive to painful stimuli required non invasive ventilation. National Institute of Health, United States Govt.[16] on COVID-19 treatment guidelines mentioned that panel recommends that High-Flow Nasal Cannula Oxygen therapy over Non invasive Positive Pressure Ventilation. **Lingzhong Meng** et al [17] mentioned requirement of intubation and invasive ventilation at some point in the course of disease in 3.2% patients having COVID 19.

The oxygenation requirements as per the different modalities is clearly mentioned in table 4 which shows patients having SpO_2< 88% despite supplementation required more non invasive ventilation (NIV) and intubation. Carter C et al[18] mentioned that NIV is an appropriate bridging adjunct in the beginning of disease progress and may prevent the need for intubation or invasive ventilation. As per National Health Service, England[19] in COVID-19, BiPAP may have a clinical use to improve the work of breathing and optimise the clinical condition of the patient.

Vital capacity (VC) is generally defined as the maximum amount of air any person can expel from the lungs after a maximum inhalation which can be easily measured by a wet or regular spirometer[20,21]. In the present study, we observed that intubation was needed in 16% patients of COVID-19 in which Vital capacity was less than 2500 ml. NIV was required in 18% patients where VC was less than 2500 ml. This clearly depict that lung capacity is consistently affected in COVID-19 and deterioration is further detrimental with decreasing VC. Torres-Castro R[22] mentioned that COVID-19 patients have impaired lung function post infection and worst affected parameter is diffusion capacity. Lower respiratory muscle strength and impaired diffusing-capacity was noted in more than half of the COVID-19 patients in early convalescence phase by Huang Y et al[23].

In the present study, moderate dose single inotropic support was required in 8% patients each who were on NIV or intubation. No inotropic support was required in any of the COVID-19 patient who were on O2 mask support or NRBM. Patients who were on invasive mechanical ventilation are more likely to need vasopressor support[24]. Hajjar, L.A., Costa, I.B.S., Rizk, S.I. et al mentioned that Norepinephrine is the first line vasopressor in patients of COVID-19 having hemodynamic instability[25]. Arentz M et al mentioned that two thirds of ventilated COVID-19 patients require vasopressor support and they recommended norepinephrine and vasopressin[26].

As the severity of lung damage increases, higher modalities of treatment like NIV and intubation are needed. We also observed the same trend in our study. Franconne M et al[27] mentioned about association between a CT score of 18 or greater and an increased mortality risk in patients with COVID-19.

CONCLUSION:

This study was conducted to review COVID-19 Scoring system proposed by Khandelwal et al[4]. This scoring system has incorporated the key parameters where total score is to be calculated out of 19. As the score increases, the chance of requirement of tracheal intubation increases. The effectiveness of this scoring system need to be assessed on large scale. The present study can reinforce the present scoring system for some parameters where p value of <0.05 is considered statistically significant.

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