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Research Article

SpO2/FiO2 ratio: a prognostic marker for influenza patients

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ABSTRACT

Background: The objective of the study was to study the utility of SpO2 /FiO2 ratio for monitoring and predicting the outcome of H1N1 positive patients of category C.
Methods: This study is a hospital based observational study done at Government Medical College, Nagpur, Maharashtra, India from 14th January to 15th April 2015. In this study, 156 H1N1 positive patients of category C were included.
Results: 156 Patients were included. 96 were female and 60 were male patients. SpO2/FiO2 ratio was calculated on day one and values were used to divide patients into 5 groups. Highest mortality (70%) is seen in a group with SpO2/FiO2 ratio < 150. SpO2/FiO2 ratio progressively dropped in patients who died. SpO2/FiO2 ratio gradually improved in patients who survived.
Conclusions: SpO2/FiO2 ratio on day 1 can be used as a prognostic marker in H1N1 positive patients. SpO2/FiO2 ratio was found to be a reliable marker to monitor the patients.

Keywords: SpO2/FiO2 ratio, H1N1, Influenza, Prognostic marker

INTRODUCTION

With the start of year 2015, India faced epidemic of H1N1 Influenza. Number of critically ill patients was admitted in hospitals over a short period of time. In such situation it is very important to predict which patients in the ICU will require critical care resources, such as mechanical ventilators and what will be the prognosis of a patient. Most of the patients of influenza die due to ARDS. According to New Berlin definition [1], PO_2/FiO_2 ratio is required to categories patients. Arterial blood gas analysis for each patient may prove impractical with a large number of patients and constrained resources. So in this study we tried to find out the utility of SpO_2 /FiO_2 ratio for monitoring and predicting the outcome of H1N1 positive patients of category C admitted in Government Medical College, Nagpur, Maharashtra, India from 14th January' 2015 to 15th April'2015.

METHODS

This study is a hospital based observational study done at Government Medical College, Nagpur, Maharashtra, India from 14th January to 15th April 2015. In this study, 156 H1N1 positive patients of category C [2] were included. Inclusion criteria were H1N1 positive patients of category C of age more than 12 years. Continuous monitoring of SpO_2 was done. At the same time record of Fio_2 requirement of patients was kept. SpO_2 was measured with pulse oximetry. We calculated SpO_2 /FiO_2 on the day of admission, on day3, day 5, day 7, day 10 and day of discharge or death. Patients were monitored till discharge or death. While calculating SpO_2 we avoided confounding factors like abnormal haemoglobin, peripheral circulatory failure, nail polish etc.

RESULTS

156 patients were included. 96 were female and 60 were male patients. The mean age of patients was 42.5 ± 14.75 years. Oxygen supplementation as required by the patients is shown in Table 1.

Table 1: Oxygen support in study subjects.

O_2 Support	Total	Survivors	Non- Survivors
No O2 Supplement	30	30	00
O2 with Bag and Mask	49	49	00
Non Invasive Positive pressure Ventilation	23	23	00
Invasive ventilation	54	2	52

SpO_2 was normal in 30 patients on admission despite their chest signs and they did not require oxygen supplementation. All of them survived. Oxygen by Reservoir Face Mask was required for 49 patients for maintenance of their SPO_2 above 90% and all these patients survived and were discharged. 23 patients were managed with Non-invasive positive pressure ventilation and all survived. 54 patients required invasive ventilation. Only 2 out of 54 patients survived.

Table 2: Mean SPO2/FiO_2 Ratio on Day 1.

Groups	SPO_2/ FiO_2 Ratio	Total	Survivors	Non-Survivors
Group 1	>400	70	68 (97.1%)	2(2.8%)
Group 2	316-400	45	20(44.4%)	25(55.5%)
Group 3	236-315	12	4(33.3%)	8(66.6%)
Group 4	150-235	15	8(53.3%)	7(46.6%)
Group5	<150	14	4(28.5%)	10(71.42%)

SpO_2/FiO_2 ratio was calculated on day one and values were used to divide patients into 5 groups as per Modified Sequential Organ Failure Assessment (MSOFA) Score[3]. In each group, percentage of survivors and non survivors was calculated and then compared with other groups. Results are shown in Table 2.

Mean SpO_2/FiO_2 ratio on admission was 393.5±100.23 in Survivors as compared to 277.88±105.46 in Non-Survivors. Out of 70 patients with SpO_2/FiO_2 >400, 2 patients (2.8%) died, whereas out of 14 patients with SpO_2/FiO_2 <150, 10 patients (71.42%) died. Increase in mortality is seen as the SpO_2/FiO_2 ratio dropped. Inverse relationship was seen between SpO_2/ FiO_2 ratio and mortality ($p < 0.0001$). Mortality was significantly high in patients with SpO_2/FiO_2 ratio < 150.

Continuous monitoring was done with SpO_2. SpO_2/FiO_2 ratio was calculated on Day 3, day 5, day 7, day 10 and day of discharge or death and tried to find out their relationship with mortality. Observations are shown in Table 3.

Table 3: Progression of SpO2/FiO2 ratio in survivors and non-survivors.

Day	SpO_2/FiO_2 ratio in Survivors	SpO_2/FiO_2 ratio in Non-Survivors
Day 1	394	277
Day3	312	104
Day 5	352	104
Day 7	377	112
Day 10	414	100
Day of discharge	462	-
Day of death	-	62.9

SpO2/FiO_2 ratio progressively dropped in patients who died. SpO2/FiO_2 ratio gradually improved in patients who survived (Figure 1). Above results showed that SpO_2/FiO_2 ratio is a reliable marker to monitor and to predict outcome of H1N1 positive patients.

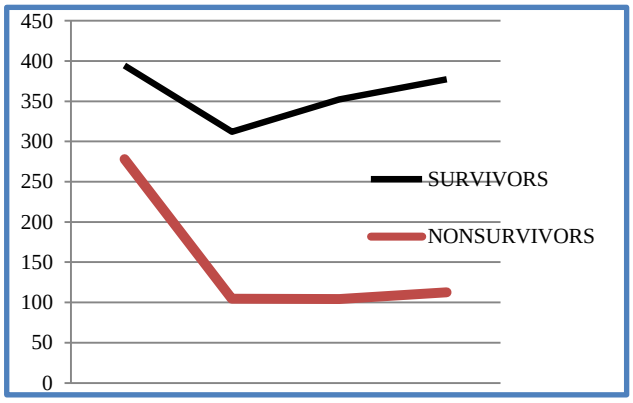

Figure 1: SPO_2/FIO_2 ratio trends in survivors & non-survivors.

DISCUSSION

It is very important to know the respiratory status of a case of H1N1 influenza. The SOFA [4] score is a validated measure of organ failure over time and a predictor of mortality in critically ill patients. But repeated arterial blood gas analysis may prove impractical. Hence this study was undertaken to find out effectiveness of SpO_2/FiO_2 ratio in monitoring of patients and predicting their outcome.

Pulse oximetry is the most commonly utilized technique to monitor oxygenation which is non-invasive and safe. In this method arterial haemoglobin O_2 saturation is measured by differentiating oxyhemoglobin form

deoxygenated haemoglobin using their respective light absorption at wave lengths of 660 nm (red) and 940 nm (infra-red).[5] It is a very easy method to know the status of patients.

Various studies are done in past which have compared SpO_2/FiO_2 ratio with PO_2/FiO_2 ratio to know their relationship. In the study done by Todd W. Rice et al, it was found that An SpO_2/FiO_2 ratio of 235 corresponded with a PO_2/FiO_2 ratio of 200, while SpO_2/FiO_2 ratio of 315 corresponded with a PO_2/FiO_2 ratio of 300.[6] Thus continuously monitored SpO_2/FiO_2 ratio can be used as a surrogate for the PO_2/FiO_2 ratio. The use of the SpO_2/FiO_2 ratio may better facilitate the screening and rapid identification of clinical status of patients and can be used to predict prognosis while avoiding repeated arterial punctures and reducing the cost of blood gas determinations.

In our study, we found significant relationship between SpO_2/FiO_2 ratio and mortality. Hence we came to the conclusion that instead of doing arterial blood gas analysis every time we can easily monitor H1N1 positive patients with SpO_2/FiO_2 ratio. It can also help to take important decisions regarding ventilatory support. This will decrease the burden over the Health care system during H1N1 epidemics. Thus SpO_2/FiO_2 ratio on day 1 as well as serial monitoring can be used as a prognostic marker in H1N1 positive patients.

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