Journal of Population Therapeutics &Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v30i17.2986

ADDRESSING OXYGEN SURGE DURING COVID-19 2ND WAVE IN PUBLIC SECTOR HOSPITALS IN WEST BENGAL.

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Abstract-

Introduction: Covid 19 is an infectious disease caused by a virus of Coronavirus family- *SARS Cov 2*. Genetic make-up of the virus is responsible for causing hypersensitivity reaction which causes acute respiratory distress. Severe cytokine storm causes systemic manifestation like Disseminated Intravascular Coagulation. However, vast majority of cases do not develop such manifestation and mere isolation is required. The cases which do require oxygen therapy may be required intermittently through a oxygen concentrator or through a portable oxygen cylinder. However, in less than 15% require continuous oxygen support through devices like Pressure Swing Absorption or Liquid Medical Oxygen supply devices or a manifold tank.

Material and Methods: Before the anticipated surge of Covid 19 cases the state government in conjunction with the central government and obtained the help of development partners prepared action plan and implemented the setting up of oxygen plants at the district hospital. This data has been obtained from the development partners who implemented the oxygen production plants at the district hospitals. The data regarding the utilization was obtained from the state government. The data collection has been obtained with mandatory confidentiality clause.
At an average of 8% occupancy, its use was optimum as it was not stretched as 2nd wave subsided. Considering the large number of populations in West Bengal, India absolute number of cases were large.

Conclusion: Moreover, Covid 19 due to extensive mass vaccination the disease has becoming endemic and it is unlikely to have SARS like manifestation. Mass vaccination as of March 2023 has been highly effective in ending the pandemic in India.

Keywords- Covid 19, Oxygen Surge, Liquid Oxygen Plants

Introduction-

India, officially the Republic of India is a country in South-Asia and a union of states is sovereign, secular, democratic republic with a parliamentary system of Government. West Bengal is one of the constituent states located in eastern part of the nation with densely populated and comprises of 23+1 (capital Kolkata) districts as of 2020 [1}. The state is one of the most vulnerable climatically and 30% of its population is still living below poverty line. The present scenario of W. Bengal healthcare system is mixed with public and private where private healthcare delivery system function at the secondary and tertiary level. These health care institute as per mandate of the state government has take a formal approval from the state government to function as per state laws. People availing treatment in these facilities need have to bear high out of pocket expenses.
Covid 19 disease has been characterized by acute respiratory distress. There is also on record of development of severe hypersensitivity reaction caused by cytokine storm. Elderly patients and with comorbid conditions like diabetes, hypertension and ischemic heart disease have risk of sudden death. There are also in clinical records patients have developed Disseminated Intravascular Coagulation. Covid 19 caused by SARS CoV 2 is not a new pathogen. In early part of 20th Century, a disease was caused by a virus of Coronavirus family which was characterized by severe acute respiratory syndrome was termed as SARS. This was in 2003 and Middle East Respiratory Syndrome in 2010 but all those had a very short incubation period, high case fatality rate and low transmissibility. This is in contrast to Covid 19 which had high transmission rate, long incubation period and comparative low case fatality. So, based on previous experiences and suggestion of expert group Central government of India braced itself for an oxygen requirement and also isolating the cases for a type of barrier nursing. Hence directive was issued to the all the state government for prepare to ramp up the health facilities for isolating the cases. Since as per Indian constitution health is managed by the state government, but however when a health incidence is declared which would require additional support federal government issues directives and state are bound to follow that. Covid 19 outbreak in India is such a situation. [2, 3]

The 1st outbreak of Covid 19 was reported in 17th March2020 [4] in West Bengal and there was steady increase in the number of cases [2.3]. This was called the 1st wave of Covid 19 this subsided by December 2020. State governments had started ramping up the facilities with various international organization like WHO, UNCEF, UNDP and PATH. However, Covid 19 has been an extra ordinary scenario. Immediately after the 1st wave subsided March 2021 onwards there was a steady increase in the number of cases. This variant was due to a genetic mutation in the cases of SARS CoV 2 virus which had a greater affinity to the respiratory tract and hence the higher risk of respiratory distress. During the period of March 2021 and June 2021 the situation was such bad that non-medical use of oxygen had to be diverted for medical use only. Corporate sector was also asked to chip in help as a part of Corporate Social Responsibility.

Categorization of Covid 19 care facility- Level 1 Covid Care facility- in these facilities no oxygen is required. This facility is meant for only isolation of Covid 19 patients. All the patients were placed under observation of a treating doctor. Level 2 were the hospitals also called Dedicate Covid Care Health Center. It has the provision of oxygen supply through type B oxygen cylinders. Level 3 Covid care facility also called Dedicated Covid Hospital (DCH). Oxygen supply to the patents admitted here would be through various means of oxygen supply.

Oxygen cylinders are black body with white shoulders with pin index configuration of 2-5. The cylinders are used intra hospital and interhospital transport of patients.
E type cylinders which are used for anesthesia work stations. This has a capacity of 660 L, F type cylinders with a capacity of 136o litters. There are the following types,
H type cylinders with a capacity of 6900 litters supplying central oxygen supply. Since most commonly used cylinders used for recusation or temporary care is type F cylinders therefore there is a always a risk of sources running out and keeping a gross estimate while using these types of

cylinders. These types of cylinders are not useful treatment of Covid 19 patients who require continuous oxygen supply.

Oxygen concentrator produce oxygen from ambient air. Used only for limited period supply. Devices which could produce oxygen supply in a continuous manner are Pressure Swing absorption Plant- However this plant may not be highly efficient in terms of producing large volume of oxygen as a cryogenic plant, this may be installed around a health facility to produce urgent oxygen supply. These plants require constant power supply. Other supply mechanism is vacuum pressure swing absorption. Repurposed from industrial use. Can operate in a remote area. Deployable Oxygen Concentration system repurposed from defense production and space industry. Experts are of the opinion this cannot be used life support and life sustaining.
In simple words the medical oxygen differs from industrial oxygen in the following manner. Medical

Oxygen (Medical grade IP 2010) is one of the purest forms of oxygen (99.0–100% purity), certified to be used by humans as a treatment or support against various illnesses
It is free from halogen and other toxic impurities. World health organization (WHO) states that medical oxygen should be at least 82% pure, free from any contamination and generated by oil-free compressor. Crisis in India during the Covid 19 second wave- These variants caused a wide spread crisis in India. Media created a sensational news headline. Health System was beefed up. As of 12 April 2021, the medical oxygen consumption in India was 3842 MT, which is 54% of the daily production capacity. Letter by Government of West Bengal on rationale use of oxygen- Simple measure like saturation pressure of oxygen as measured by pulse oximeter to be used as a monitoring tool. [5-7]

Indication	Oxygen evice	Flow rate	Target Spo2	Indicate for escalation	Indication for de-escalation
SpO2 =85-93% on admission	Nasal Prongs	1-6 L/min	a. Initial stabilization:>94%	↑	↓
SPO2 less than <85%	Simple Face Mask	6-10 L min	b. After Initial stabilization: 92-96%		
	NRBM	10-15 L/min			
	HFNO	Up to 60 L. Min			

WHO estimates oxygen requirement during Covid 19 outbreak for a 100 bedded hospital.

Formula:
Total oxygen in l/min = (Number (No.) of beds except ICU and OT × 0.75 l/min) + (No. of beds in OT × 7 l/min) +(No. of beds in ICU × 30 l/min).

Example:
In a 100-bedded hospital with 25% ICU beds (n = 25), and five Operation theatres (n = 5), we can calculate the oxygen requirement by using the formula:

Total Oxygen (l/min) = [{100-(25 + 5)} × 0.75] + (5 × 7) + (25 × 30) = 841.25 l/min.

This calculation remains fairly valid for all oxygen delivery systems except when HFNC is used, which delivers oxygen up to 60 l/min, in which case a higher oxygen supply will be needed. Also, in COVID care units, the flow rate varies. In adults suffering from Covid-19, oxygen requirement in severe condition (oxygen requirement needed, ICU support not required) is at 10 l/min flow rate and in critical condition (requiring ICU support) is at 30 l/min. Therefore, the total oxygen flow rate for the hospital or that particular ward or floor changes. To understand the gravity of the consumption of oxygen in severely infected COVID patients requiring oxygen is that a regular E size oxygen gas cylinder would be consumed in approximately 1.5 hours if flow rate of 10 l/min has to be maintained.

Objectives of this study- Narrative review of the preparation made in the state-run public-sector hospitals in West Bengal to address the oxygen surge during the 2nd wave of Covid 19 pandemic with the help of development partners.

Methods- All the data was collected after discussion with various development partners who worked with the state governments in strengthening continuous oxygen delivery mechanism in the state. This data is specifically for all the state government run dedicated health facility.

Observations and Results-

Name of the district	Bed reserved for Covid 19 treatment (actual and planned)	Beds reserved for Covid 19 (with oxygen support (actual and planned	Average occupancy rate %	Present Oxygen Demand/consumption Per day (in MT)	Future Oxygen Demand/consumption Per day (in MT)
Alipurduar	891	58	8	2.8499976	8.1075744
Bankura	1882	449	8	18.7667712	7.7783328
Birbhum	2918	300	8	13.3137072	39.714768
Coochbehar	1095	142	8	8.8277904	4.0743648
Dakshin dinajpur	618	51	8	2.2223808	4.11552
Darjeeling	1365	358	8	21.0611736	9.7949376
Hooghly	1692	591	8	21.3801264	11.3999904
Howrah	2702	755	8	32.92416	18.416952
Jalpaiguri	1515	164	8	7.4182248	10.083024
Jhargram	1088	329	8	8.7146136	14.815872
Kalimpong	309	0	8	0.9568584	2.05776
Kolkata metropolitan district	9639	3504	8	211.239353	56.5266672
Malda	713	229	8	16.3797696	3.08664
Murshidabad	2115	874	8	28.8497952	4.5682272
Nadia	1236	312	8	10.9472832	6.790608
North 24 Parganas	3786	1150	8	37.1014128	15.8035968
Paschim Bardhaman	1428	606	8	29.528856	1.440432
Paschim Medinipur	1657	333	8	13.2108192	11.729232
Purba Bardhhaman	1295	598	8	25.0943832	0
Purba Medinipur	1737	681	8	19.5898752	8.539704
Purulia	660	175	8	6.4099224	6.996384
South 24 Parganas	2163	646	8	21.6476352	14.4248976
Uttar Dinajpur	764	190	8	5.3193096	5.041512

Table 1. In all the districts of West Bengal arrangements to provide oxygen support to admitted Covid 19 patients requiring oxygen. (Personal collection by Sri Jaydev Kole during his tenure with PATH)

Assuming future occupancy at 50%. However, the 2nd wave subsided before requirement for such occupancy required.

Name of the district	Medical Gas Pipe Line supported beds	Addressing Present Deficit of Oxygen in District			
		Cylinder Requirement D type	OR Cylinder Requirement B type	OR PSA PLANT (in LPM)	OR LMO tank
Alipurduar	60	121.76	617.4971429	602.6169678	1.082039751
Bankura	873	1486.375587	7538.047619	7356.399057	13.20891483
Birbhum	450	979.9876056	4969.937143	4850.17378	8.708816894
Coochbehar	112	752.3094836	3815.28381	3723.344775	6.685518778
Dakshin dinajpur	203	197.0985915	999.5714286	975.4841951	1.751548218
Darjeeling	1565	1705.735962	8650.518095	8442.061708	15.15829596
Hooghly	175	1681.9923	8530.10381	8324.549113	14.94729411
Howrah	290	3030.786103	15370.41524	15000.02572	26.93356637
Jalpaiguri	52	461.4060094	2339.987619	2283.599625	4.10035844
Jhargram	550	587.7784038	2980.87619	2909.044345	5.223386973
Kalimpong	6	69.24056338	351.1485714	342.6867473	0.615317362
Kolkata metropolitan district	2580	19590.88563	99353.77714	96959.59344	174.0975445
Malda	900	-519.2542723	-2633.360952	-2569.903376	-4.614436298
Murshidabad	300	659.8999061	3346.635238	3265.989491	5.86430626
Nadia	1332	1015.923756	5152.184762	5028.029675	9.028169252
North 24 Parganas	742	3453.932958	17516.37429	17094.27239	30.6939287
Paschim Bardhaman	360	2379.746291	12068.71333	11777.88678	21.14799675
Paschim Medinipur	339	1177.555117	5971.886667	5827.978764	10.46453225
Purba Bardhhaman	1478	2204.337089	11179.1381	10909.74813	19.58919477
Purba Medinipur	850	1604.694836	8138.095238	7941.986992	14.2603778
Purulia	65	545.0276056	2764.068571	2697.46126	4.843475155
South 24 Parganas	1160	-1085.015587	-5502.579048	-5369.980313	-9.642164879
Uttar Dinajpur	300	-531.1442254	-2693.66	-2628.749364	-4.720098271

Table 2a: Addressing Oxygen deficiency in public health facilities (data collection by Mr. Jaydev Kole during his tenure with PATH)

There was no plan for Medical Pipe Line based Gas Pipe lined supply in any of the district.

Name of the district	For Removing Future Deficit of Oxygen in District			
	Cylinder Requirement D type	OR Cylinder Requirement B type	OR PSA PLANT (in LPM)	OR LMO tank
Alipurduar	675.4903286	3425.700952	3343.149915	6.002853048
Bankura	864.851831	4386.034286	4280.341557	7.685644383
Birbhum	3261.289014	16539.39429	16140.83522	28.98196742
Coochbehar	40.21446009	203.9447619	199.0301906	0.357372244
Dakshin dinajpur	275.8591549	1399	1365.287512	2.451466585
Darjeeling	1391.209765	7055.420952	6885.402516	12.36320851
Hooghly	1566.768075	7945.752381	7754.279128	13.92333556
Howrah	4425.537653	22443.7981	21902.9573	39.32824951
Jalpaiguri	429.2895775	2177.111429	2124.648353	3.814950621
Jhargram	1818.9123	9224.48381	9002.196248	16.16405563
Kalimpong	-0.289014085	-1.465714286	-1.430394146	-0.00256837
Kolkata metropolitan district	19600.35042	99401.77714	97006.43676	174.1816549
Malda	-529.8920188	-2687.309524	-2622.551919	-4.708970337
Murshidabad	707.5483568	3588.280952	3501.812133	6.287741853
Nadia	326.7774648	1657.228571	1617.293405	2.903960305
North 24 Parganas	3850.491831	19527.49429	19056.9293	34.21801267
Paschim Bardhaman	2134.555681	10825.24667	10564.38463	18.96907111
Paschim Medinipur	1024.436995	5195.359048	5070.163566	9.103823518
Purba Bardhhaman	980.8189671	4974.153333	4854.28837	8.716204921
Purba Medinipur	1427.604883	7239.99619	7065.529941	12.68663955
Purulia	54.83230047	278.0780952	271.3770914	0.487276025
South 24 Parganas	-254.0676056	-1288.485714	-1257.436351	-2.25781249
Uttar Dinajpur	-716.7241315	-3634.815238	-3547.225056	-6.369283845

Table 2b: Addressing Oxygen deficiency in public health facilities (data collection by Mr. Jaydev Kole, during his tenure with PATH)

Conclusion- In this observation it can be said that whatever the arrangements was made to address oxygen surge was adequate as occupancy remained at 50%. Crisis was a media hype to beat up sales of media in a crisis. Moreover, it can be said in a resources constrained settings maintaining huge infrastructure for oxygen delivery is possibly not required as on a daily basis. Preparing for an emergency is unnecessary

References-

1. Profile - India At A Glance - Know India: National Portal of India [Internet]. Know India. india.gov.in. Available from: https://knowindia.india.gov.in/profile/india-at-a-glance.php
2. Zirpe KG, Dixit S, Kulkarni AP, Pandit RA, Ranganathan P, Prasad S, et al. The second- vs first-wave COVID-19: More of the Same or a Lot Worse? A Comparison of mortality between the Two Waves in Patients Admitted to Intensive Care Units in Nine Hospitals in Western Maharashtra. Indian J Crit Care Med [Internet]. 2021;25(12):1343–8. Available from: http://dx.doi.org/10.5005/jp-journals-10071-24042
3. WHO technical consultation on oxygen access scale-up for COVID-19. World Health Organization; 2021.
4. Sindwani G, Suri A. Acute hospital oxygen shortage during COVID-19 pandemic surge: how can we prevent the apocalypse? Brazilian Journal of Anaesthesiology (English Edition). 2021 Nov;
5. Todur P, Chaudhuri S, Nileshwar A. Research in respiratory care. Indian Journal of Respiratory Care. 2020;9(1):1.
6. West Bengal reports first positive case of coronavirus. The Economic Times [Internet]. [cited 2023 Jan 29]; Available from: https://economictimes.indiatimes.com/news/politics-and-nation/west-bengal-reports-first-positive-case-of-coronavirus/articleshow/74680463.cms
7. Bangla [Internet]. Wb.gov.in. 2022 [cited 2023 Jan 29]. Available from: https://wb.gov.in/pdf/OMS(English)