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Original Research Article

Lessons for pandemic management in rural healthcare settings in India: a retrospective cohort study of COVID-19 in a rural COVID care centre

Seetharam Mysore R.[1]*, Vidyashree M.[1], Sydney Shields[2], Kumar Gavali Suryanarayana[1], Priyanka Catherine Mani Kalliath[1], Vishwesh Vishnu Naik[1], Mohan Kumar B. Thambad[1], Anantha Kumar Srinivasaiyer[1]

[1]Department of Medical Specialities, Vivekananda Memorial Hospital, Swami Vivekananda Youth Movement, Saragur, Mysuru, Karnataka, India
[2]Department of Global Health Studies, The University of Iowa, Iowa City, Iowa, USA

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***Correspondence:**
Dr. Seetharam Mysore R.,
E-mail: emmaress@svym.org.in; emmaress@gmail.com

ABSTRACT

Background: The COVID-19 pandemic has affected billions of lives across all countries precipitating an unprecedented demand for simultaneous curative, preventative, promotive, and curative services which has impacted the entire healthcare system. Even as it continues to rage across the globe, it is pertinent to learn from current experiences to build resilience into the system, especially for the vulnerable populations in rural areas.
Methods: A retrospective cohort study of COVID-19 was conducted at COVID care centre in Vivekananda Memorial Hospital. A total of 136 COVID-19 confirmed patients were included in the study. Epidemiological and clinical profiles of patients were summarised. The association between risk factors and COVID-19 disease progression and patients' outcomes at discharge were analysed and adjusted risk ratios were presented.
Results: Out of the 136 patients, 128 were discharged uneventfully, 7 were referred to a higher centre because of disease progression and one patient died due to cardiac arrest. The study showed statistically significant association between age above 50 years and the presence of diabetes with COVID-19 disease progression. Delayed presentation for care also carried a higher risk of negative outcomes. Significant number of diabetics had derangement of their glycaemic control during the period of study.
Conclusions: The study has highlighted the importance of ensuring essential non-COVID public health services, especially targeted follow-up of older adults, people with diabetes for their treatment adherence and early detection and treatment initiation of COVID-19 amongst them.

Keywords: COVID-19, COVID care centre, COVID-19 disease progression, Diabetes, Pandemic management, Rural healthcare settings

INTRODUCTION

The COVID-19 pandemic has impacted billions of lives across all countries and continues to rage even now. As of August 2021, India stands second in the world in terms of confirmed cases (32.77 million) and 438560 deaths.[1] The pandemic has precipitated an unprecedented demand for simultaneous curative, preventative, promotive, and curative services, especially to vulnerable populations in rural areas.

Various measures have been instituted by the Government to contain the spread and manage the disease, including nationwide lockdowns and strengthening healthcare delivery. Research has continuously contributed to understanding the virus behaviour and disease progression to predict and alter the

outcomes in COVID-positive patients. Previous studies have shown the association between pre-existing comorbidities and specific investigatory findings with a higher risk of progression to severe disease and mortality.[2-6] However, clinical presentations and outcomes of patients with COVID-19 have been variable across populations and countries.[2-4] A retrospective cohort study was conducted at Vivekananda Memorial Hospital (VMH), a rural healthcare facility located in Mysuru, India catering to predominantly rural communities, to analyse disease progression and outcomes of COVID-19 patients and thereby identify modifiable risk factors and early signs of disease progression in rural populations. The findings of the study contribute to designing and implementing contextually effective approaches relevant to rural, resource-poor settings.

Given the setting of a rural, remote location, basic level of medical facilities, socio-economically challenged rural population, and the logistic challenges of accessing tertiary care, this study evaluated the association of socio-demographic and clinical determinants with COVID-19 disease progression.

METHODS

Study design and setting

The study adopted a retrospective cohort study design. It was conducted at VMH, a 100-bed secondary healthcare institution catering to rural and tribal communities in Saragur, Mysuru district, Southern India. VMH was designated as a COVID care centre. COVID care centres were established to treat mild or asymptomatic COVID-19 positive patients.

Participants

The study population consisted of confirmed COVID-19 positive patients admitted to the centre between August-2020 and November 2020. Patients who were alive at discharge were followed up for outcome on the 60th day.

The entire process of patient management including screening, admission, investigations, treatment, and referral was done in adherence to the then-prevailing guidelines issued for the purpose by Government authorities.[5]

Outcome measures

The following outcome measures were included in the study.

Progression to severe COVID-19 infection

An individual was considered to have a serious COVID-19 infection if any of the following conditions was present: (a) shock (b) seizure (c) meningitis/encephalitis (d) anaemia (e) cardiac arrhythmia (f) cardiac arrest (g) pneumonia (h) bronchiolitis (i) acute respiratory distress syndrome (ARDS) (j) stroke: ischaemic stroke (k) stroke: intracerebral haemorrhage (l) bacteraemia (m) bleeding (n) endocarditis (o) myocarditis/pericarditis (p) acute renal injury (q) pancreatitis (r) liver dysfunction (s) cardiomyopathy. The definition was adapted from the WHO case record form.[6]

In addition, we have also added worsening of comorbidities such as deranged diabetes (RBSG of >200 mg/dl) and thrombophlebitis.

Outcome at discharge

The outcome at discharge was documented as 'recovery' (the person was discharged after being asymptomatic for the previous 3 days after admission), 'referral made to a higher centre' because of disease progression or 'death'.

Outcome on 60th day

The outcome on the 60th day was documented as 'recovery' or 'death'.

Data collection

Patient data were collected from medical records by trained medical officers using a case report form adapted from a rapid core case report form (WHO) which was integrated into KoboToolbox.[7]

Table 1: Data collection modules.

Module 1: Status on the first day of admission	Module 2: Status on every fifth day of admission	Module 3: Status on the day of discharge and on the 60th day after discharge
Date of admission, criteria for COVID testing, age, gender, ethnicity, religion, temperature, heart rate, respiratory rate, blood pressure, oxygen saturation, comorbidities, signs and symptoms, symptom onset and remission date, medication, oxygen therapy, lab investigations, chest x-ray	Temperature, heart rate, respiratory rate, blood pressure, oxygen saturation, signs and symptoms, medication, oxygen therapy, lab investigations	Complications, medication, chest x-ray, oxygen therapy, outcome at discharge, outcome on 60th day

The case report form included sociodemographic characteristics (age, sex, ethnicity, and socioeconomic status) and clinical characteristics (symptoms/signs, biochemical and radiological investigation and clinical stage of COVID-19 infection at admission and during

hospitalization if any), and consisted of three modules, as detailed in (Table 1). Outcome on the 60th day after discharge was collected through phone calls.

Sample size

The required sample size for the study was 68 and it was calculated based on the risk ratio for the association between disease progression and presence of comorbidities from the study that evaluated progression to severe COVID-19 and risk factors conducted in Chennai.[8]

Statistical analysis

Data was analysed using R version 3.6.2.[9] The results were presented in the following subheadings, demographic and socioeconomic characteristics, distribution of exposure variables and distribution of outcome measures, and the association between exposure variables and outcome measures. Continuous variables were presented as medians with first quartiles (Q1) and third quartiles (Q3) and categorical variables were presented as proportions with 95% confidence intervals. Outcome analyses were presented in terms of proportions with 95% confidence intervals. Association analyses were carried out using stepwise regression method. Crude risk ratios for the association between an outcome measure and an exposure variable was calculated using binary logistic regression. The statistically significant exposure variables ($p<0.05$) were included in multiple logistic regression to calculate adjusted risk ratios.

The outcome measures 'progression to severe COVID-19 infection' and 'outcome at discharge' were evaluated in the light of age, gender, pre-existing comorbidities, time from symptom onset to hospital care, clinical symptoms and signs, and biochemical (CRP) and radiological investigations (chest x-ray).

RESULTS

Participants

A total of 136 patients were included in the study. Out of these one died during hospitalization. Out of the remaining 135, 14 were lost to follow-up because they were not reachable on phone even after phone calls on the 60th, 61st, and 62nd days.

Population characteristics at admission

Demographic and socio-economic characteristics

Of the 136 patients, 76 (55.9%) were male and 60 (44.1%) were female. The most common reasons for COVID testing were physician-initiated referral due to clinical suspicion (50/136; 36.8%) and contact of a case (28/136; 20.6%) (Table 2). The median age of the patients was 45 years (Q1-Q3: 30-55 years). Out of the 136 patients, one patient belonged to an indigenous tribe categorised as a Particularly Vulnerable Tribal Group.[10]

Table 2: Population characteristics at admission.

Variables	Categories	Number of patients (%)
Age group	0-35	47 (34.6)
	35-50	49 (36)
	Above 50	40 (29.4)
Gender	Female	60 (44.1)
	Male	76 (55.9)
Ethnicity	Tribal	1 (0.7)
	Non-tribal	135 (99.3)
Comorbidities	Present	52 (38.2)
	Absent	84 (61.8)
Multiple comorbidities	Single comorbidity	31 (22.8)
	Double comorbidities	18 (13.2)
	Triple comorbidities	3 (2.2)
Symptoms at admission	Present at admission	106 (78.7)
	Absent at admission	30 (21.3)
Symptoms	Fever	71 (52.2)
	Dry cough	41 (30.1)
	Headache	21 (15.4)
	Muscle aches	16 (11.8)
	Cough with sputum production	9 (6.6)
	Shortness of breath	8 (5.9)
	Fatigue/ malaise	7 (5.1)
	Runny nose	6 (4.4)
	Other (wheezing, chest pain, joint pain, loss of taste, loss of smell, nausea, reduced appetite, diarrhoea, dyspepsia, increased flatulence, abdominal pain, sleeplessness, anxiety)	13 (9.6)
Clinical stage at hospital admission	Asymptomatic	28 (20.6)
	Mild	99 (72.8)
	Moderate	8 (5.9)
	Severe	1 (0.7)

Comorbidities

About a third of patients (52/136; 38.2%; CI: 30.2-47.0%) in this study had at least one chronic condition upon admission. About a fourth (31/136; 22.8%; CI: 16.2-30.9%) had single comorbidity, 13.2% (18/136; CI: 8.2-20.4%) had two comorbidities and 2.2% (3/136; CI: 0.6-6.8%) had three comorbidities. The most common comorbidities were diabetes (41/136; 30.1%), hypertension (18/136; 13.2%) and chronic cardiac disease (6/136; 4.4%) (Table 2). Of the 41 patients who had

diabetes, 8 (19.5%) were newly detected during hospitalisation. Diabetes and hypertension coexisted in a tenth of the patients (13/136; 9.6%).

Clinical characteristics

Most (109/136; 80.1%; CI: 72.3-86.3%) patients were symptomatic at some point during hospitalization. Of the 109, 106 (77.9%) patients were symptomatic at admission and 3 developed symptoms after admission. The most common symptoms were fever (71/136; 52.2%), dry cough (41/136; 30.1%), headache (21/136; 15.4%), muscle aches (16/136; 11.8%), and productive cough (9/136; 6.6%) (Table 2). Of these 109 patients, both onset and remission dates of symptoms were known for 93 patients. The median time taken for symptom remission was 6 days (Q1-Q3: 4-8 days). Of the 106 patients who were symptomatic at presentation, the date of symptom onset was known for 102 patients, of whom 51 (50%) presented 2 or more days after symptom onset. Median number of days of delay to the hospital was 3 (Q1-Q3: 1-4 days).

Table 3: Vital parameters at admission.

Vitals at admission	Number of patients	Normal range	Abnormal values (%)	Median (Q1-Q3)
Temperature in °C	136	<37.5	7 (5.1%)	37 (36.6-37)
Respiratory rate (breaths/min.)	136	12-25	11 (8.1%)	22 (20-24)
Oxygen saturation in %	134	>92	11 (8.2%)	97 (96-98)
Heart rate (beats/min.)	136	60-120	38 (27.9%)	90 (86-98.5)
Blood pressure (systolic) (mm/Hg)	133	60-140	4 (3%)	110 (110-120)
Blood pressure (diastolic) (mm/Hg)	133	<90	3 (2.2%)	70 (70-80)

Table 4: Biochemical parameters at admission.

Investigations	Number of patients	Normal range	Abnormal values (%)	Median (Q1-Q3)
CRP (mg/l)	115	0-5	39 (33.9)	2.3 (0.5-11.2)
Creatinine (mg/l)	112	0.9-1.3	44 (39.3)	1 (0.8-1.1)
WBC count (/mm^3)	124	3500-10000	18 (14.5)	5940 (4970-7202.5)
Haemoglobin (g/dl)	125	11.5-15.5	19 (15.2)	13.3 (12.2-14.9)
Haematocrit (%)	125	35-52	22 (17.6)	40.7 (37.8-45.5)
Platelets (/mm^3)	124	150000-1000000	7 (5.6)	252500 (204500-302250)

Vital parameters at admission

Heart rate, respiratory rate, temperature, blood pressure, and oxygen saturation were documented at admission for all patients, with abnormal findings in 38 (tachycardia in 27.9%), 11 (tachypnoea in 8.1%), 7 (fever in 5.1%), 4 (hypotension in 3%), and 11 (hypoxia in 8.2%) respectively (Table 3).

Biochemical parameters at admission

At admission, 33.9% (39/115; CI: 25.5-43.4%) patients had abnormal CRP, 15.2% (19/125; CI: 9.6-23%) were anaemic, 39.3% (44/112; CI: 30.3-49%) had abnormal creatinine, 14.5% (18/124; CI: 9.1-22.2%) had abnormal WBC count, 17.6% (22/125; CI: 11.6-25.7%) had abnormal haematocrit, 5.6% (7/124; CI: 2.5-11.7%) patients had platelets count of less than 150000/mm^3 (Table 4).

Treatment

Most (109/136; 80.1%) patients received symptomatic treatment with paracetamol and/or decongestants; 86 (63.2%) patients received supportive treatment; 24 (17.6%) patients received tablet hydroxychloroquine; 44 (32.3%) patients received injection low molecular weight heparin; 5 (3.7%) patients received injection remdesevir; 13 (9.6%) patients received injection ceftriaxone; 30 (22.1%) patients received steroids; 18 (13.2%) patients received oxygen therapy during hospitalization (Table 5).

Table 5: Treatments.

Variables	Categories	Number of patients (%)
Treatments	Supportive treatment	86 (63.2)
	Ayurveda supportive treatment	29 (21.3)
	Symptomatic treatment with paracetamol and/or decongestants	109 (80.1)
	Tab. hydroxychloroquine	24 (17.6)
	Inj. low molecular weight heparin	44 (32.4)
	Inj. remdesevir	5 (3.7)
	Inj. ceftriaxone	13 (9.6)
	Steroids (tab. dexa, tab. prednisolone)	30 (22.1)
	Oxygen therapy	18 (13.2)

Outcomes

Progression to severe COVID-19 infection

Among the 136 patients, 46 (33.8%; CI: 26.1-42.5%) patients progressed to severe COVID-19 infection. Of these, a quarter (34/136; 25%) had pneumonia and about a tenth (16/136; 11.8%) had derangement of diabetes (Table 6).

Outcomes at discharge and 60th day

Of 136 patients admitted to VMH, 128 (94.1%; CI: 88.4%-97.2%) were discharged alive, 7 (5.1%; CI: 2.3-10.7%) were referred to higher centre and 1 (0.7%; CI: 0.04-4.6%) patient died in the hospital. Of 135 patients who were included in the 60th day follow-up, 120 (88.9%; CI: 82-93.4%) patients had recovered and reported healthy, 14 (10.4%; CI: 6-17.1%) patients were lost to follow-up and 1 (0.7%; CI: 0.04-4.7%) patient had died (Table 6).

Risk factors for progression to severe COVID-19 infection

In the univariate analysis (Table 7), the following risk factors were found to be significantly associated with progression to severe COVID-19 infection: diabetes (CRR: 3.95; 2.46-6.35); hypertension (CRR: 2.06; 1.3-2.37); symptoms (CRR: 2.6; 1.02-6.63); age over 50 years (CRR: 2.4; 1.54-3.74); CRP (CRR: 4.22; 2.4-7.43); delayed presentation to the hospital (CRR: 3.1; 1.7-5.64); Coexistence of diabetes and hypertension (CRR: 1.99; 1.2-3.3).

Table 6: Outcomes.

Outcomes (n= number of patients)	Categories	Number of patients (%)
Progression to severe COVID-19 infection (n=136)	Pneumonia	34 (25)
	Uncontrolled diabetes	16 (11.8)
	Cardiac arrest	1 (2.2)
	Worsening hepatic encephalopathy	1 (2.2)
	Thrombophlebitis	1 (2.2)
	Severe respiratory acidosis	1 (2.2)
Outcome at discharge (n=136)	Recovered/discharged alive	128 (94.1)
	Referred/transfer to other facility	7 (5.1)
	Death	1 (0.7)
Outcome on 60th day (n=135)	Recovered/healthy	120 (88.9)
	Death	1 (0.7)
	Unknown/lost to follow-up	14 (10.4)

Table 7: Univariate analysis of risk factors for progression to severe COVID-19 infection.

Variables (n)	Categories	Patients with progression to severe COVID-19 infection	Patients without progression to severe COVID-19 infection	CRR (95% CI)
Diabetes (136)	Present	29	12	3.95 (2.46-6.35)*
	Absent	17	78	Reference
Hypertension (136)	Present	11	7	2.06 (1.3-3.27)*
	Absent	35	83	Reference
Symptoms (136)	Yes	42	67	2.6 (1.02-6.63)*
	No	4	23	Reference
Age (136)	>50	23	17	2.4 (1.54-3.74)*
	0-50	23	73	Reference
CRP (115)	Abnormal	26	13	4.22 (2.4-7.43)*
	Normal	12	64	Reference
Delayed presentation to the hospital (102)	Yes	31	20	3.1 (1.7-5.64)*
	No	10	41	Reference
Diabetes and hypertension (136)	Yes	8	5	1.99 (1.2-3.3)*
	No	38	85	Reference

*p value<0.05, **p value<0.1; n= number of patients; CRR- crude risk ratio

Table 8: Multivariate analysis of risk factors for progression to severe COVID-19 infection.

Variables	Categories	Patients with progression to severe COVID-19 infection (n=48)	Patients without progression to severe COVID-19 infection (n=77)	aRR (95% CI)
Diabetes	Present	26	12	2.45 (1.45-4.16)*
	Absent	12	65	Reference
CRP	Abnormal	26	13	2.38 (1.42-3.97)*
	Normal	12	64	Reference
Age group	>50	19	15	2.81 (0.93-8.53)**
	35-50	16	24	2.48 (0.82-7.50)
	0-35	3	38	Reference

*p value<0.05, **p value<0.1; n= number of patients; aRR- adjusted risk ratio

Table 9: Univariate analysis of risk factors associated with outcome at discharge.

Variables (n)	Categories	Discharged alive	Referred/death	CRR (95% CI)
Age (136)	>50	34	6	7.2 (1.52-34.17)*
	0-50	94	2	Reference
Hypertension (136)	Present	12	6	19.67 (4.29-90.06)*
	Absent	116	2	Reference
Diabetes and hypertension (136)	Present	9	4	9.46 (2.68-33.44)*
	Absent	119	4	Reference
CRP (115)	Abnormal	35	4	7.79 (0.9- 67.38)**
	Normal	75	1	Reference
Delayed presentation to the hospital (102)	Yes	45	6	6 (0.75-48.08)**
	No	50	1	Reference

*p value<0.05, **p value<0.1; n= number of patients; CRR- crude risk ratio

In the multivariate analysis (Table 8), CRP (aRR: 2.38, 1.42-3.97), diabetes (aRR: 2.45, 1.45-4.16), and age greater than 50 years (aRR: 2.81, 0.93-8.53) were found to be significantly associated with progression to severe COVID-19 infection. No other exposure factors such as gender, other comorbidities, investigations were significant in this analysis.

Determinants of outcome at discharge

In the univariate analysis (Table 9), age over 50 years (CRR: 7.2; 1.52-34.17), hypertension (CRR: 19.67; 4.29-90.06) and coexistence of diabetes and hypertension (CRR: 9.46; 2.68-33.44) were found to be significantly associated with negative outcomes (referral to a higher centre or death) at discharge.

DISCUSSION

Age above 50 years, delay in presentation, pre-existing comorbidities, abnormal CRP were found to have a significant association with progression to severe COVID and negative outcomes. These findings are similar to other studies which also found higher morbidities and mortality with these parameters.[11-17] The potential implications and the possible way forward as relevant to resource-limited settings of rural India are discussed in the section below.

The rural Indian health care system has been plagued with multiple ills; including poor infrastructure, inadequate human resources and skewed manpower distribution which are magnified by constraints imposed by poor basic infrastructure like roads, transportation, power, communication and issues around governance.[18,19] Simultaneously, the communities too have been slow to adopt recommended healthy lifestyles and health-seeking behaviours as seen in relation to other health determinants.[18] These challenges exist even in urban settings, with vulnerable populations like slum dwellers facing the brunt. Despite these adverse situations, the public health system continues to be the mainstay of healthcare delivery in rural India and thus would be critical in combating the COVID pandemic.[20]

Current experience from the world over indicates a high degree of complexity of care of advanced COVID-19 infection, with its inevitable escalation of costs and demands on infrastructure.[21] It is therefore imperative to explore cost-effective strategies for pandemic management be explored which can be incorporated into the existing healthcare delivery system with minimal damage to the routine healthcare services.[22]

The factors that could potentially influence outcomes were considered in three categories to encompass preventive, promotive as well as curative considerations- before symptom-onset- demographic factors,

comorbidities, after symptom-onset, but before presentation to hospital- access to testing, reports, health-seeking behaviours, after presentation to hospital- condition at presentation, supportive/symptomatic treatment, clinical/investigation markers which can indicate disease progression.

Before symptom-onset- care in the community

COVID-19 patients with an age beyond 50 years carried a significant risk of complications and unfavourable outcomes compared to younger patients. This association has been reported by many studies. In a meta-analysis on the effect of age on the incidence of COVID-19 complications, Tiruneh et al found on univariate meta-regression that as the mean age increased by one year, the incidence of acute respiratory distress syndrome, acute kidney injury, acute cardiac injury, and shock increased by a factor of 2.9.[11]

Presence of pre-existing comorbid conditions, especially diabetes either alone or in combination with hypertension, predisposed patients to a higher risk of complications and progression to severe disease. A study done in Delhi investigated the high prevalence of diabetes and other comorbidities in hospitalized COVID-19 patients and their association with outcomes and found that the group with diabetes had a higher proportion of severe cases, mortality, ICU admission, and oxygen requirement.[12] This link between diabetes and poor outcomes has been observed and reported in many of the other studies.[23,24]

The findings indicate the need for effective control of the risk factors irrespective of COVID-19. Access to general healthcare during the COVID times has been seen to be adversely affected due to factors like the closure of public and private health centres, lack of public transport, which have hampered COVID Care delivery despite repurposing the healthcare facilities for COVID care.[19] Strengthening the non-COVID healthcare sector is essential to prevent situations that weaken the body's response against various diseases including, but not limited to, COVID-19. Approaching it from both sides- compulsory screening for comorbidities among COVID patients, and a higher degree of suspicion of COVID among elderly and patients with comorbidities, would help in ensuring early identification of patients at risk for COVID and its complications.

After symptom-onset- ensuring early care

Delay in presenting to the hospital after symptom onset was found to significantly increase the risk of complication, progression of the disease and negative outcomes in the current study.

In our study, physician referral was the commonest reason cited for patients getting tested, ahead of the contact-tracing mechanisms laid down by the Government including mandatory screening and testing of primary contacts. This could be reflective of the fears in the community about the disease and misconceptions about what might happen if the test comes positive. This also could indicate the influence that the physician exerts on positive health-seeking behaviour, highlighting the potential role of the primary physician in promoting early identification and safe community behaviour.

Prompt reporting for care demands efficiency at symptom detection, sampling, testing, reporting and report disbursement. Considerable delays were reported by patients at all these stages. Previous studies have also reported the benefits of early detection and institution of care.[15,25]

After presentation to hospital- caring for COVID patients in resource limited settings

We found that if the patients present early, the majority of them could be managed in our peripheral centre with minimal medical interventions, close monitoring of clinical parameters and basic investigations. The main investigations done for tracking disease progression were CRP and chest x-ray, both of which are widely available, and were significantly associated with complications and disease progression. The other standard investigations like D-dimer, ferritin, LDH, etc. were not done as the centre was not equipped for such tests at the time of the study, in spite of which morbidity and mortality could be kept at levels reported by other studies.[3]

Hypoxia upon admission carried a significant risk of complications and negative outcomes.[8,26] A study done in Chennai, India, found that patients with no clinical signs of disease had low oxygen saturation and drew a similar conclusion that early hypoxia was associated with a higher risk of complications.[8] Our study reiterates their recommendation of checking oxygen saturation levels every four hours to promptly identify early desaturations, provide oxygen therapy, and facilitate early referral to higher centres as needed. Setting up systems for early identification of fall in saturation is essential. This would be best achieved by a combination of steps to identify COVID-19 as early as possible, and initiating monitoring of O_2 saturations early.

Derangement of glycaemic control was found in a significant number of diabetics during the study period, which required appropriate titration of anti-diabetic medications. Such derangements were also reported by other studies.[27]

While the mechanisms leading to this situation are not elucidated, it could be surmised to be due to factors including but not limited to: 1) beta cell damage due to SARS-Cov-2 virus; 2) medications like steroids as part of COVID management; 3) missing out on regular anti-diabetic medications due to non-availability of healthcare, logistic challenges due to lockdown and other issues; 4)

the emotional stress induced by the panic and fear related to the disease.[28,29]

It is pertinent to note that factors 2, 3 and 4 are potentially modifiable and their impact can be reduced by judicious use of medications and holistic disease management.

In the current study, the hospital stay period was utilised as an opportunity for interaction with patients and their attendants to provide appropriate behaviour change communication (BCC) by trained counsellors, which helped to allay fears and cope with the stress better.

The hospital received patients from all strata of the community (rural-urban; male-female; tribal-non tribal; all income levels). An intrinsic limitation of the study was that only mild and moderate cases could be admitted in accordance with the guidelines of the health department.[5] The defined outcomes were objectively assessed based on clinical, biochemical and radiological parameters thus reducing the bias in measurement. The sample size as calculated prior to the completion of the study was 68. When sample size was calculated post hoc based on the lowest risk ratio of 1.99 that was found for the association between the coexistence of hypertension and diabetes and progression to severe COVID-19 infection, the required sample size was 218. So the current study may be underpowered to measure the risk factors for progression to severe COVID-19 infection.

CONCLUSION

Age above 50 years, diabetes, hypertension, delayed presentation for care carry a higher risk for disease progression and negative outcomes.

Effective management of comorbid conditions is essential for protecting those vulnerable to COVID and its complications

Early detection and institution of care is an important prerequisite for pre-empting disease progression.

Triaging at admission and meticulous monitoring for disease progression through SpO_2, chest x-ray and CRP, and subsequent referral for escalation of care would help manage the majority of the patients in peripheral units thus decongesting the tertiary care centres.

Involving physicians in BCC promotes better health-seeking practices in the community. Alleviating myths and misconceptions through effective BCC is essential for combating panic and promoting COVID appropriate behaviour, and should be made an integral part of activities in all centres managing COVID.

Based on the above conclusions, we would recommend that the healthcare delivery systems be strengthened for early testing, prompt reporting, decentralised initial care with monitoring and selective referrals. Adopting a targeted intervention approach would ensure adequate prioritisation of the population at risk, especially the elderly and those with comorbidities. Strengthening the primary care network should be accorded high priority as it would contribute significantly towards achieving all the above.

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