DRUG UTILIZATION EVALUATION IN COVID- 19 HOSPITALIZED PATIENTS: A RETROSPECTIVE STUDY

Abstract

Introduction: Corona disease 2019 (COVID-19) is an airborne viral infectious disease caused by severe acute respiratory syndrome corona virus 2 (SARS-CoV-2) mutant. Transmission can occur if splashed or sprayed with contaminated fluids in the eyes, nose, or mouth, and, rarely, via contaminated surfaces. Symptoms are slightly variable with the mutants, and the general is fever, cough, headache, fatigue, breathing difficulties, and loss of smell and taste. The co-morbid diseases like cancer, cardiovascular disease, diabetes, hypertension, and chronic respiratory disease & the elderly are more likely to develop severe illnesses. The standard diagnostic method and treatment pattern varies from hospital to hospital, provokes to carry out this project.

Objectives: To assess the drug treatment pattern, antibiotic usage patterns, and cost, determine the antiviral usage pattern and its price. Estimate anti–interleukin-6 receptor monoclonal antibody (Tocilizumab) usage and cost.

Methodology: A retrospective observational study was conducted in Sagar Hospitals, Kumaraswamy Layout, Bangalore, for six months after obtaining ethical clearance using a well-designed questionnaire.

Results and Discussion: 155 Cases were collected from the medical records department. The most widely used antibiotic was Ceftriaxone, 60.6%, a cell wall synthesis inhibitor, followed by Azithromycin, 59.4%, a protein synthesis inhibitor. The most widely used antiviral was Oseltamivir in 51.6%, Remdesivir in 41.3% of patients, and Favipiravir in 12.3%. Other co-morbid drugs are corticosteroids, immunomodulators, mucolytics, antihistamines, blood thinners, and anti-helminthes. The mean cost of the antibiotics and antiviral are 224 ± 295.73; 1623.28 ± 2047.45.

Conclusion: This study showed that in the management of COVID 19, ICMR Guidelines were adopted. The cost of the drugs also played a significant role in selecting treatment regimens, especially antibiotics, antiviral, and immunomodulators. Hence the cost consideration studies may help in Rational drug usage promotion and cost-minimization in disease management.

Keywords: Covid 19, DUE: Drug utilization evaluation, Antibiotics, D –Dimer, RTPCR, and CRP- C reactive protein.

INTRODUCTION

Coronaviruses (COVID-19) are zoonotic airborne viral infectious diseases (transmitted between species from animals to humans or vice versa) First identified this case in Wuhan, China, in December 2019 became a pandemic globally. These caused a severe acute respiratory syndrome (SARS-CoV-2) due to various viruses mutant by breathing infected airborne particles / inhaled over longer distances, particularly indoors. The transmission also occurs if splashed or sprayed with contaminated fluids in the eyes, nose, or mouth, rarely via contaminated surfaces & people remain contagious for up to 20 days and can spread the virus even if they do not develop symptoms. (1-2)

Symptoms of COVID-19 are variable but often include fever, cough, headache, fatigue, breathing difficulties, and loss of smell and taste. The incubation period is 1-14 days. One-third of people who are infected are asymptomatic (3-4)

Several research studies showed that most patients (approx 81%) develop mild to moderate symptoms like mild pneumonia. Intermediate level of patients (i.e., 14%) develop severe symptoms like dyspnea, and hypoxia, with lung anatomical and physiological changes, and only 5% suffer acute/critical symptoms like respiratory failure, shock, or multiorgan dysfunction with intensive care.

The geographical variations, age, and co-morbid chronic diseases like diabetes, hypertension, cancer, cardiovascular diseases, and respiratory infections are likely to develop more severe/intense illnesses. Various challenges are associated with treating geriatric COVID-19

patients experiencing interstitial pneumonia, including delirium, acute respiratory distress syndrome (ARDS), super bacterial infections, sepsis, and septic shock. Chronic symptoms and organ damage were observed in patients after recovery. The standard diagnostic method detects the virus nucleic acid by real-time reverse transcription-polymerase chain reaction (RRT-PCR) and high-resolution computed tomography (HR-CT). (1-4)

The various Complications of Covid 19 are Acute Respiratory Failure, Pneumonia, Acute Respiratory Distress Syndrome (ARDS), Acute Liver Injury, Acute Cardiac Injury, and Secondary Infections. AKI, septic shock, Disseminated Intravascular Coagulation.

The Management of Covid-19, according to WHO, includes,

Mild disease: Symptomatic patients without viral pneumonia or hypoxia. Control of the infection: Isolation, Symptomatic treatment such as antipyretics, adequate nutrition, and rehydration. Counsel the patients on alarming symptoms. No antibiotic therapy.

Moderate disease (pneumonia): Clinical signs and symptoms include fever, cough, dyspnoea, fast breathing), and SPO2>90%. The Management consists of Isolation, Antibiotic/no antibiotics prescribed until a clinical suspicion of bacterial infection. Geriatric patients have been prescribed antibiotics for prophylaxis—close monitoring of patients for signs or symptoms of disease progression.

Severe disease (severe pneumonia): Clinical signs and symptoms include fever, cough, dyspnoea, fast breathing, respiratory rate>30bpm, SP02 <90%. The diagnoses consist of radiograph, CT scan, and ultrasound. The Management of the infection: The patients should be equipped with pulse oximetry and disposable oxygen delivering interfaces—immediate administration of supplemental oxygen therapy. Closely monitor patients for signs of clinical deterioration like respiratory failure and shock. Use conservative fluid management.

Acute respiratory distress syndrome /Critical disease (ARDS): Clinical presentation showed Onset is within one week. The oxygen levels in various stages Mild ARDS: 200mmHg<PaO2. Moderate ARDS: 100mmHg<PaO2.Severe ARDS: 100mmHg>PaO2.*The* Management of infection includes Treated with high flow nasal oxygen (HFNO) systems or endotracheal intubation to be performed by a trained and experienced provider. Ventilation for 12-16 hours. Can be given Extra Corporal Membrane Oxygenation under too severe conditions.

Critical/Acute disease (Septic shock): Clinical presentation includes acute life-threatening organ dysfunction with persistent hypotension without affect volume resuscitation. Serum lactate > 2mmol/L. *The Management* includes Vasopressors to maintain mean arterial pressure. Give 250-500ml crystalloid fluid as a rapid bolus in the first 15-30 min to maintain the fluid balance.

DUE: The ultimate goal of a DUE or MUE is to provide better patient care through the best treatment and make sure the medicines are according to the current standards of care. Different purposes of DUE are 1. to create rules for suitable drug utilization. 2. To evaluate the efficacy of treatment with drugs. 3. To enhance management in the drug use techniques. 4. To control the cost of drugs. 5. To prevent drug-associated problems like ADR, lack of success in the treatment, too much use and less use of drugs, inaccurate doses, and use of medicines not in the formulary.
6. To sort out areas requiring more knowledge and studies for individuals who practice medicine
The different types of DUE are prospective, retrospective, and concurrent DUE methods.
Prospective DUE: A review must be done prospectively by evaluating the patient's pre-planned drug theory before describing the medication. This type of DUR paves the way for a pharmacist to assess the dosage of prescription drugs and the interaction of drugs and to clear the problems associated with drug use.
Concurrent DUE: It is performed during therapy and continuous monitoring of treatment with medicines to attain positive outcomes from the patient.
Retrospective DUE: It is a treatment review after medication administration by a patient. This review aims to find the trends in prescribing, dispensing, and advertising medication, thereby helping to prevent duplication. Retrospective drug utilization programs are structured ongoing initiatives that interpret drug use patterns concerning predetermined criteria and attempt to minimize inappropriate prescribing. (4)
NEED FOR THE STUDY: The treatment regimen is diverse in different parts of the world and differs from patient to patient. This study was carried out to know the various treatment patterns and their outcome in the hospital setup. This study will aid in assessing treatment protocol, its outcome, and its cost.

*OBJECTIVES***:**

Primary Objective: To understand the drug treatment pattern in the Covid 19 Disease management.

Secondary Objective:

To assess the antibiotic & antiviral usage pattern & their cost.

To evaluate the cost of anti–interleukin-6 receptor monoclonal antibody *(Tocilizumab)*

METHODOLOGY

The study was a retrospective observational study conducted in Sagar Hospitals, Kumaraswamy Layout, Bangalore, for six months (November 2021 to April 2022). One hundred fifty-five cases were collected from the medical records from March 2020 to June 2021 in the Sagar Hospitals, Kumaraswamy Layout, after obtaining ethical clearance from the hospital by considering the criteria's are

Inclusion criteria: Patients with RT-PCR, Rapid RT-PCR, and Rapid Antigen test positive for COVID-19 virus.

Exclusion criteria: Non-COVID-19 patients

A patient profile form was designed to collect the data from the medical records in the hospital. The document contains the demographics of the patient like age, gender, date of admission (DOA), date of discharge (DOD), In-patient identification number (IPID), etc., past medical and medication history, and the reason for admission, laboratory data, details of the medicines like brand name, generic name, frequency, dose, and the duration of the therapy, from the medical records. The obtained patient's result was subjected to descriptive statistics using SPSS 20 [th] version.

Results:

Out of 155 patients, males were 66.5%, and 33.5% were females.

Table 1: Distribution of Age category of the patients

Age category	N (%)
20-29	4(2.6)
30-39	23(14.8)
40-49	32(20.6)
50-59	36(23.2)
60-69	30(19.4)
70-79	24(15.5)

80-89	5(3.2)
90-99	1(0.6)
Total	155(100)

The age category of the patient showed more were at the age of 50-59(23.2%), followed by 40-49 (20.6%) followed by 60-69(19.4%) & least were 90-99(0.6%). The mean age of the patients was 54.58 ± 15.08.

Figure 1: Distribution of number of day's patient stayed in the hospital
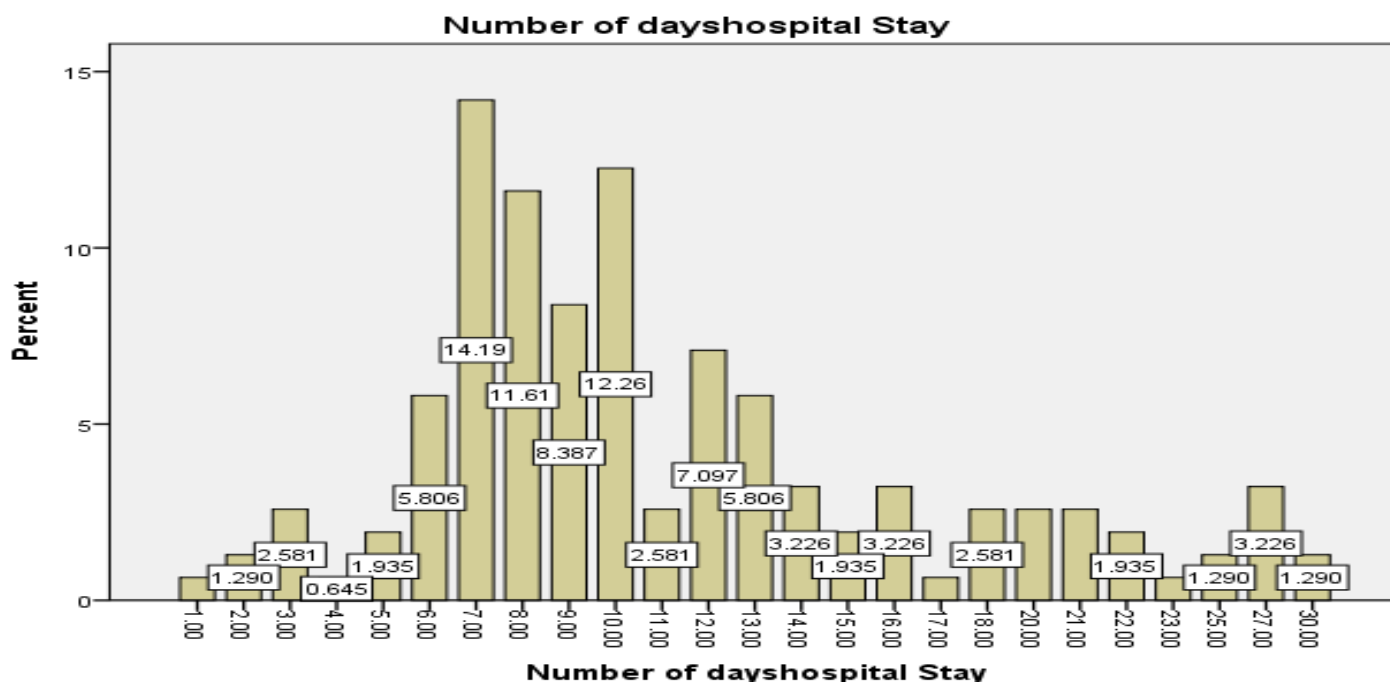
About 14.9% of patients stayed at the hospital for 7 Days, and the least was 0.64% for four days. The mean number of hospital stays was 11.41±6.01 Days.

Table2: Distribution of the chief complaints of the patients

Chief complaints	N(%)
Fever &cough	26(16.8)
Fever+cough+ headache +loss of appetite	3(1.9)
Fever+weakness+loose stools + cough	19(12.3)
Cough	5(3.2)
Intermittent cough	1(0.6)
Cough+weakness	6(3.9)
Fever+weakness+altered sensorium	1(0.6)
Fever+weakness	16(10.3)
Fatigue+loss of appetite	1(0.6)
Fever+weakness+cold +cough	32(20.6)
Breathlessness	8(5.2)

Fever+headache +throat pain	1(0.6)
Fever+cough+generalised weakness	2(1.3)
Cough +loose stools	1(0.6)
Generalisedweakness+breast lump	1(0.6)
Chest pain	2(1.3)
AsymptomaticCovid	2(1.3)
Fever+generalisedweakness+cough+cold+loss of taste+loss of smell	23(14.8)
Loose stools	1(0.6)
Lower back pain	1(0.6)
Abdominal Pain	1(0.6)
Reinfection with covid19	1(0.6)
Giddiness+chestdiscomfort+breathlessness	1(0.6)
Total	155(100)

In our study, 46.8 % had co-morbid disease conditions in which diabetes mellitus alone was 12%, followed by 14.6 % have both diabetes and hypertension. The other co-morbidities include ischemic heart disease 14(9%), Bronchial asthma 6(3.9%), Chronic kidney disease 5 (3.2%), and Benign Prostate Hyperplasia 3(2%). Depression, osteoarthritis, acute kidney disease, pyelonephritis, seizure, polycystic kidney disease, dyslipidemia, nephrotic syndrome, and dementia had a minor frequency of 1

Out of 155 patients, 97 had a mixed diet pattern of 62.6%, whereas 48(30.9%) followed a vegetarian diet; Diabetic and low salt diets were among 9(5.8%) patients..

Table 3: Distribution of vitals findings

	Systolic BP	Diastolic BP	Systolic BP at discharge	Diastolic BP at discharge	Respiratory rate	RR at discharge
N	155	155	155	155	155	155
Mean ± SD	125.61 ± 16.03	80.20± 9.72	114.33± 30.08	75.19 ± 11.75	21.99 ± 4.30	20.41 ± 5.29
	Pulse rate	Pulse rate at discharge	Temperature (F)	Partial pressure of oxygen	Partial pressure of oxygen at discharge	Cost of vital test
N	155	155	155	155	155	155
Mean	84.18	79.48	98.76	95.14	96.77	100

The mean systolic BP was 125.6 at the time of admission and 114.3 at discharge. The respiratory rate was 21.9 at entry and 20.4 at discharge. The pulse rate was 84.1 at admission

and 79.4 at discharge. The mean temperature at the time of admission was 98.76, and the mean partial pressure of oxygen at admission and discharge was 95.14 and 96.77, respectively. The total cost of the necessary test was 100rs.

Table 4: Distribution of HRCT report

HRCT Report	N(%)
Patchy areas of ground glass opacities	23(14.9)
Extensive patchy consolidation and ground glass opacities	7(4.5)
Multiple irregular pneumonitis	2(1.3)
Data not available	123(79.3)
Total	155(100)

Out of 155 patients, 123 observations of HRCT (High resolution Computed tomography) data were not available. This is 79.3%. Found Patchy areas of ground-glass opacities in 14.9% of patients. Also, multiple irregular pneumonitides were observed in 1.3% of patients.

Table5: Distribution of HRCT Score

HRCT score	N(%)
1/40	1(0.6)
11/25	1(0.6)
12./40	1(0.6)
13/25	1(0.6)
16	1(0.6)
18/40	2(1.3)
24/40	1(0.6)
4/25	1(0.6)
5/25	1(0.6)
6/25	1(0.6)
7/25	2(1.3)
8/25	1(0.6)
9/25	1(0.6)
data not available	140(90.3)
Total	155(100)

Out of 155 patients, 140 patients' data was unavailable, which is 90.3% and 1.3% of patients had scores of 18/40 and 7/25.

Table6: Distribution of Positivity confirmatory test

Type of test	No. of observations	Percentage

Rapid-RTPCR alone	0	0
RT-PCR	151	97.4
Rapid RTPCR + RT-PCR	4	2.6
Total	155	100

Out of all the patients, 97.4% were confirmed positive by RT-PCR only, whereas 2.6%tested showed positive by both Rapid RT-PCR and RT-PCR, and admission was made based on Rapid RT-PCR alone.

Table 7; Distribution of the Severity category

Severity category	N(%)
Mild	20(12.9)
Moderate	118(76.1)
Severe	17(11.0)
Total	155(100)

Out of 155 patients, 12.9% were diagnosed with mild disease, 76.1% were diagnosed with moderate, and 11% were diagnosed with severe disease.

Table 8: Distribution of Chest x-ray report

Chest X ray report	N(%)
data not available	77(49.7)
bilateral infiltrate and haziness+cardiomegaly	7(4.5)
Normal	4(2.6)
patchy areas of consolidation and poor respiratory effort	56(36.1)
Extensive haziness	3(1.9)
Pleural effusion	1(0.6)
Lungs hyper Inflation	1(0.6)
Prominent Broncho vascular marking	4(2.6)
Cardiomegaly+right hemi diaphragm	1(0.6)
Aorta is unfolded	1(0.6)
Total	155(100)

Found Patchy areas of consolidation in 36.1% of the patients, bilateral infiltrates and haziness with cardiomegaly were found in 4.5% of patients, Found extensive haziness in 1.9%of the

issues, and Prominent Broncho vascular marking was found in 2.6% of patients. Other inferences included were pleural effusion, Hemi diaphragm, and hyperinflation of the lungs.

Table 9: Distribution of hematology report

Hematology report	Mean + SD
N	155
HB	13.59 ± 2.76
HB At discharge	13.54 ± 2.77
Platelets	2.70± 0.910
Platelets at discharge	3.03 ± 1.35
WBC	7520.30 ± 3841.12
WBC at discharge	8578.90 ± 4261.83
Neutrophils	76.12 ± 51.51
Neutrophils at discharge	65.56± 15.46
Lymphocytes	20.67± 12.86
Lymphocytes at discharge	27.57± 27.50
MCV	86.37±8.43
MCV at discharge	88.18±4.80
MCH	29.83±1.963
MCH Discharge	29.60±1.60
MCHC	35.47±1.88
MCHC at discharge	35.38±1.82
Total hematology cost	1188.38± 82.92

The mean hemoglobin at the time of admission was 13.59 ±2.76, and Hb at discharge was 13.5 ±2.7. Platelets at admission and discharge were 2.7±0.9 and 3.03±1.35, respectively. WBC at admission and discharge was 7520.3±3841.2 and 8578.9±4261.8, respectively. The neutrophil count at entry was 76.1±51.9 and at discharge was 65.5±15.4. Lymphocytes at admission and discharge were 20.6±12.8 and 27.5±27.5, respectively. The MCV at entry was 86.3±8.4and at discharge was 88.1±4.8. Found MCH at admission was 29.8±1.9; at discharge, it was recorded as 29.6±1.6. MCHC at admission was found to be 35.4±1.8, and at discharge, it was 35.38±1.8. The total cost of the hematological test was 1188.38±82.9

Table10: Distribution of hepatology report

Hepatology report	Mean + SD

N	155
Direct bilirubin	2.39 ± 25.04
Direct bilirubin at discharge	0.30 ± 0.12
Indirect bilirubin	0.70± 0.71
Indirect bilirubin at discharge	0.69 ± 0.41
AG ratio	1.03 ± 0.15
AG ratio at discharge	1.06 ± 0.12
Serum albumin	3.62 ± 0.62
serum albumin at discharge	3.73± 0.33
Serum globulin	3.56± 0.51
Serum globulin at discharge	3.53± 0.34
Total protein	6.93±1.11
Total protein at discharge	7.06± 0.46
SGOT	34.66±21.88
SGOT at discharge	33.38±17.10
SGPT	43.35±29.19
SGPT at discharge	51.94±20.26
BUN	15.82 ± 9.93
BUN at discharge	19.02 ± 7.07
Total hepatology cost	

The mean direct bilirubin value at admission was 2.3, and at discharge, I saw it as 0.3. The mean of indirect bilirubin, A/G ratio, at admission & discharge was 0.7 and 0.69; 1.03 & 1.06. The mean SGOT at admission & discharge was 34.6 and 33.3. The mean SGPT at entry was 43.3 and at release was 51.9. The mean serum albumin at the entrance was found to be 3.6and at discharge. It was 3.73. The mean serum globulin at admission was found to be 3.5and at release. It was 3.5. The mean total protein at the entrance was found to be 6.9and at discharge, it was 7.06. The mean Blood Urea Nitrogen at admission and discharge was 15.8 and 19.0, respectively.

Table11: Distribution of serum electrolytes

Serum electrolytes	Serum Sodium	Serum sodium at discharge	Serum potassium	Serum potassium discharge	Serum chloride	Serum chloride at discharge
Number	155	155	155	155	155	155
Mean	137.90	137.90	4.85	4.17	103.84	102.65

| Std. Deviation | 7.24 | 5.17 | 4.56 | 0.60 | 10.72 | 4.02 |

The mean serum sodium, potassium, and Chloride, at admission and discharge, were 137.9±7.2 and 137.9±5.1.; 4.8±4.5 and 4.1±0.6; 103.8±10.7 and 102.6±4.0. The mean Blood Urea Nitrogen at admission and discharge was 15.8±9.9 and 19.0±7.1, respectively.

Table 12: Distribution of covid specific tests

Covid specific test	D Dimer	D dimer at discharge	CRP	CRP at discharge	LDH	LDH discharge	Total cost of covid specific test
Number	155	155	155	155	155	155	155
Mean	1912.29	813.24	56.99	50.91	320.52	261.77	2800
Std. Deviation	8214.60	2266.88	324.04	449.46	184.19	126.12	0.00

The mean D Dimer value at admission and discharge was 1912.29 and 813.24. The mean of CRP at admission and discharge was 56.9 and 50.91. The mean LDH value at admission and discharge was 320.52and 261.7, respectively. The total cost of these Covid specific tests was 2800/ INR.

Table13: Distribution of clinical outcome of the patients

Clinical outcome	N(%)
Completely recovered	129(83.2)
Home Quarantine	12(7.7)
Transferred to other hospital	14(9.0)
Total	155(100)

About 83% of patients recovered completely during their hospital stay, 7.7% were advised to home quarantine after discharge, and 9% were transferred to other hospitals before completion of treatment.

Table 14: Distribution of antibiotics& Antiviral

Antibiotics N(%)	
Yes	145(93.5)
Azithromycin	92(59.4)
Piperacillin + tazobactam	32(20.6)
Clindamycin	2(1.3)

Ceftriaxone	94(60.6)
Cefoperazone	16(10.3)
Linezolid	9(5.8)
Doxycycline.,	54(34.8)
Meropenem	6(3.9)
Teicoplanin	1(0.6)
Vancomycin	1(0.6)
Polymyxin B	2(1.3)
Anti-viral drugs N(%)	
Yes	120(77.4)
Oseltamivir	80(51.6)
Favipiravir	19(12.3)
Remdesivir	64(41.3)

Antibiotics was administered for 93.5% of the patients, Ceftriaxone was the most prescribed antibiotic (60%), followed by Azithromycin (59.4).whereas drugs like vancomycin and teicoplanin were administered to (0.6) of patients only.

About 77% of patients were prescribed antivirals,51% were prescribed oseltamivir, 12% were prescribed favipiravir, and 41% were prescribed remdesivir

Table 15: **Distribution of other category of drugs**

Prescribed	N(%)
Anti-helminthics	46(29.7)
Anti emetics(Inj. emeset 4 mg + tab emeset 4 mg + Tab. Phenergan (Promethazine) 25mg	17(10.9)+2(1.2)+1(0.6)
Anti psychotics Tab Haloperidol 2.5 mg + Tab. Haloperidol 5mg Tab. Haloperidol 5mg +Tab.Promethazine25mg	1(0.6) +2(1.2) 1(0.6)
Analgesics	72(46.2)
Corticosteroids	106(68.4)
Bronchodilator	14(9)
Anti-histamine	14(9)
Expectorant	23(14.8)
Mucolytics (acetylcysteine)	24(15.4)
Leukotriene antagonist	6(3.9)
Immunomodulators (HCQ)	42(27.1)
Blood thinners	23(14.8)
Anticoagulant	113(72.9)

Potassium reducing agents (k-bind)	9(5.8)
Anti-septic agents (betadine gargle)	1(0.6)
Laxatives (lactulose)	4(2.5)
Alkalizers (inj+ tab forms of sodium bicarbonate)	2(1.2) + 4(2.6)
Anti-anaemic (erythropoietin)	1(0.6)
Alpha receptor blockers (silodosin + tamsulosin)	3(1.8) + 1(0.6)
Anti-anginal (nitro-glycerine + isosorbide dinitrate)	1(0.6) + 1(0.6)
Thrombolytic (Tenecteplase)	1(0.6)
Sedatives (clonazepam + alprazolam +zolpidem)	4(2.5) + 1(0.6) +2(1.2)
Anti-fungal (voriconazole)	1(0.6)
Anti-fibrosis[pirfenidone] (200mg) + (400mg)	1(0.6) + 2(1.2)
Anti-hypothyroidism drugs [levothyroxine]100mcg+50mcg+25mcg	10(6.4) + 2(1.2) + 1(0.6)
Diuretics Inj: Fursoemide 10 mg/hr; inj : Furosemide 40 mg; T: Torosemide	4(2.5)+2(1.2)+ 1(0.6)

Emeset (Ondansetron) is a widely used antiemetic drug. Interestingly one patient was prescribed Phenergan(Promethazine). Corticosteroids were administered68.4% of patients, 72.9% were prescribed anticoagulants, 15.4% were administered mucolytics, whereas prescribing drugs like antiseptics were prescribed only for 0.6% of Patients. Furosemide was administered in infusion form for 2.5% of patients, intravenously in 1.2% as monotherapy, and as a combination with amiodarone tab for 0.6%, whereas torsemide was the least prescribed diuretic (0.6%). Among antipsychotics, Haloperidol (4.8%) was used in different doses, and other antipsychotic drugs, like promethazine, were 0.6%.

Table16: Distribution of Antiulcer /antacids

Antacids	N (%)
Inj pan 40mg	33(21.2%)
Inj pan 40mg/ tab pan40mg	4(2.5%)
Inj pan 40mg/ syp: sucrafil	3(1.9%)
Inj. pantoprazole 40mg + Tab.Ranitidine 150mg	1(0.6%)
N/A	25(16.1%)
Syp: Sucrofil D 2tspX 5days	1(0.6%)
T pan 40mg	68(43.8%)
T Pan 40mg+Syp Gaviscon 10ml	2(1.2%)
Trantac 150mg /t pan 40mg	5(3.2%)

tab omez 20 mg	3(1.9%)
Tab pan 40mg+ Sypmucaine gel-2tsp+Syp Gaviscon 2tsp	1(0.6%)
tab rantac 150mg	8(5.1%)
Tab.Ranitidine 150mg +Syp.Sucralfate	1(0.6%)
Total	155(100%)

Prescribed pantoprazole injection in 21% & tablet form in 43%, ranitidine 5.1%, and omeprazole 1.9%. oxetaciane, sucralfate, aluminum hydroxide, magnesium trisilicate, and milk of magnesia preparations are prescribed in various combinations.

Table 17: Distribution of Anti diabetics

Anti-diabetic drugs	N(%)
Inj ; H .Actrapid	11(7.1%)
Inj H mixtard+Tabjanumet 50/500mg+t. Gemer+Inj Human insulin	1(0.6%)
inj H actrapid , injlantus	1(0.6%)
inj H actrapid/ injtresiba 15ui	1(0.6%)
Inj : H.Actrapid, T.Metformin+glimiperide+T.torglip	1(0.6%)
Inj. Mixtard, h.actrapid, injtresiba	1(0.6%)
inj Tresiba	1(0.6%)
Inj.Humanmixtard+ Tab.Glycomet GP2forte	1(0.6%)
Inj.Humanmixtard+ Tab.Jalra (5/500	1(0.6%)
Insulin Q8/hr X 5days	1(0.6%)
N/A	120(77.4%)
T diapride + t vilapride + H. actrapid	1(0.6%)
T Glimepiride 1 mg X 7 days + Human Actropid	1(0.6%)
T Metformin SR 50mgX8days + T Glimepiride 1 mg X 4days	1(0.6%)
T. GlucoerumX 6 days	1(0.6%)
t. Glycinorm + H. actrapid	1(0.6%)

t. Glycinorm+t.vildagliptin+H. actrapid	1(0.6%)
t. Glycomet GP	5(3.2%)
t. Glycomet GP +t supermet xl +	1(0.6%)
Tab.Gluciphor G1	1(0.6%)
Tab.Glycomet(Metformin500mg)+Tab.Gemer (Glimepride+ Metformin)	1(0.6%)
Tab.JalraM(Vildagliptin 50mg+Metformin 500mg)+ Inj.Basalog (Insulin glargine) + Tab.Forxiga (Dapagliflozin)	1(0.6%)
Total	155(100%)

Human insulin was administered subcutaneously in 7.1% of the patients. Glimepiride (0.5mg) + metformin (500mg) was administered to 3.2%of the patients in combination.Also other drugs like phosphate monohydrate, glimepiride, insulin glargine, vildagliptin, insulin degludec, glycerol,zinc,glimepiride, gliclazide were administered with metformin as combinations.

Table 18: Distribution of Antihypertensive drugs

Antihypertensive drugs	N(%)
clinidipine tab 20mg,	1(0.6)
N/A	120(77.4)
T. Amlodipine 5mg	2(1.2)
T Amlong 5mg BO+ t. temisartan 40mg+t propranolol 20mg	1(0.6)
T amlong+ atenolol+losartan	1(0.6)
T Cardivas 3.125mg	1(0.6)
T . Cilacar 10mg OD /tab metpureXL 25mg OD	1(0.6)
T . Metosartan 25mg	1(0.6)
T. Olmezest, /met xl	1(0.6)
T . Prolomet 50mg	1(0.6)
T. Enalopril	1(0.6)
T. Erite LNX4mg+ T prolometxe	1(0.6)
T. MetasartanX6days+ T amlong X6days	1(0.6)
T.Telmisartan 40mg	4(2.4)
T.Telmikino X5days+ Tab OzotelX5days+T Cardivas 3.125mg	1(0.6)
Tab Concof 5mg X 10days	1(0.6)
Tab Cresar H X6days	1(0.6)
Tab Maxovas 0.2mg+ t. Cilacar 5mgX8days	1(0.6)

Tab olmezest-20mg	3(1.9)
Tab. Telmisartan 20mg	1(0.6)
Tab.Arkanim(Clonidine 100mcg)+Tab.Nebicord SM (Nebivolol+ Amlodipine)+ Tab.Olmesartan 20mg	1(0.6)
Tab.Cilamet (Metoprolol+Clinidipine)+Tab.Prazopress (Prazosin)+ Tab.moxovas (Moxonidine)+Tab.Amlong (Amlodipine)	1(0.6)
Tab.MetpureXL(Metoprolol 25mg) + Tab.Arbitel AM(Telmisartan 40mg+Amlodipine5mg)	1(0.6)
Tab.olmesartan 20mg+tab.Amlong 5mg	1(0.6)
Tab.Olmezest 25mg	4(2.5)
Tab.Prolomet XL 12.5mg X12days	1(0.6)
Tab.Telma H + Tab.Prolomet XL	1(0.6)
Total	155(100)

Telmisartan and amlodipine were administered at 1.2%, Olmesartan was prescribed to 2.5% of patients. Other anti-hypertensive's combined with telmisartan are metoprolol, enalapril, propranolol, losartan, nebivolol, cilnidipine, and prazosin.

Table 19: Distribution of Anti hyperlipidaemic

Anti-hyperlipidemic	N(%)
ATORVAS 20MG x 3DAYS	3(1.9)
Cap.Rosuvas gold (Rosuvastatin 10mg)	1(0.6)
N/A	139
T . Roseday 10mg	2(1.2)
T storvas 10 mg	4(2.5)
T storvas 40mg+	1(0.6)
T. Clopitorra 20mg	1(0.6)
T.Rosuvas 5mg	1(0.6)
T. EcosprinAV	1(0.6)
Tab Unistar 10mgX8days + Unistac gold X6 days	1(0.6)
Tab.Atorva 40mg +Tab.Rosuvas 10 mg	1(0.6)
Total	155(100)

Atorvastatin was administered in 2.5%, other antihyperlipidemic like rosuvastatin; too, and atorvastatin 20mg was administered to 1.9% of the patients

Table 20: Distribution of anti-depressants

Anti-depressants	N(%)
N/A	146(94.2)

T Bupron XL	1(0.6)
t. Eescitalopram 10mg	2(1.2)
Tab Eliwel 10 mg	1(0.6)
Tab Tryptomer 10mg	1(0.6)
Tab. Mirtazapine 7.5mg +Tab. Escitalopram 10mg	1(0.6)
Tab.Nexito plus (Escitalopram +Clonazepam)	1(0.6)
Total	155(100)

Tab tryptomer , mirtazapine, escitalopram were given to 0.6% patients and tab escitalopram was administered to 1.2% of patients as antidepressant

Table21: Distribution of the various antibiotics used & its costs

Antibiotic	N(%)	Average/Median cost	Mean + SD
Azithromycin	89 (57.4)	119.5	68.61 ± 59.28
Piperacillin + Tazobactum	25 (16.1)	450	72.1 ± 166
Clindamycin	2(1.3)	225	2.90 ± 25.47
Ceftriaxone	95(61.29)	60.5	343.2 ± 441.58
Cephaferazone + Sulbactum	16(10.3)	641.57	66.95 ± 195.83
Linezolid	9(5.8)	2841	164.9 ± 666.56
Doxycyclin	21(13.5)	38	5.14 ± 13.04
Meropenam	5(3.2)	110	3.54 ± 19.49
Ticoplanin	1(0.6)	800	5.16 ± 64.25
Vancomycin	1(0.6)	285.25	1.8 ± 22.91
Polymixin	2(1.2)	500	6.45± 56.61
Total cost of the antibiotics		124.5	224 ± 295.73

The total cost of the antibiotics mean was 224 ± 295.73.

Table 22: Distribution of antiviral Blood thinner, Anticoagulants and its cost

Anti virals(77.4%)		
Anti-viral	Frequency N(%)	Mean cost + SD
Oseltamivir	80(51.6)	324.4 ± 315.35
Fabipiravir	19(12.3)	50.24 ± 143.63
Remdesivir	64(41.3)	1248.37 ± 2021.29
Total cost of anti virals		1623.28 ± 2047.45
Blood thinners & anticoagulants		

Blood thinners	23(14.8)	3.38±21.88
Anticoagulants	113(72.9%)	226.05±208.7

The total cost of the antiviral mean was 1623.28 ± 2047.45.

The major cost of the antiviral drug is Remdisivr, followed by Oseltamivir and Fabipiravir. The anti-coagulants were used more in the Covid 19 disease management, followed by blood thinners. The total mean cost of the medications was Rs.17322.55.

Results and Discussion:

The treatment of Covid infection was a great challenge to the health care workers due to the variants of COVID-19 like alpha, beta, gamma, and delta during the second wave in various parts of the world. Delta variant was most common in South India, and there was a massive evolution in the medicines for the treatment of COVID-19. Hence this study aimed to understand the various treatment protocols used in the first & second waves in Sagar Hospitals to treat the COVID-19 infection.

Out of 155 cases, 66.5% were males, and 33.5% were females. A similar study conducted by Caruso PF et al. showed that male was 66%, and female patients were 34 %. (11).

The age-category 50-59 years were more, i.e., 23.2%, due to co-morbidities association like Diabetes, Hypertension, cardiac-related issues, and COPD/Asthma and this is the typical age group in our study's earning and retiring ages. Our study's lowest covid cases were at the age of 90-99(0.6%). A similar study conducted by Zhang W et al. study; showed 15-64 years age group of infection was 76.93% in their research.   (8, 3,20, 21).

The days of hospital stay vary from country to country and from state to state. It also depends on the severity of the case. The mean of hospital stay by the patients in our study was 11.41±6.01 Days .. Thirurengadam G etal conducted a study showed that the mean of the hospital stay was 7-17 days. (12)

The significant complaints during hospital admission are fever, cough, and cold around the globe. During June 2020 and December 2020, the most common complaints were fever, cough, generalized weakness, and cold. Later, commonly encountered loss of taste and smell along with fever, cough, and cold were due to the mutations caused by the virus to encourage its growth inside the human body. In addition, there was a complaint of re-infection too in the study. This also can be due to the mutations by the virus. In our study, fever was the most common clinical presentation in patients with COVID-19 infection.110 (70.9%) patients presented with fever. A similar study conducted by by Hema K et al. also showed 49.3 % had Fever was most common clinical presentation. (5).

Out of 155 patients only 46.8% had co morbid conditions , 14.6% had both diabetes and hypertension and, 12% had only diabetes, The results were similar to Hema K et al multicentre study. (5)

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The vital findings like BP in our study post-COVID-19 at admission [126.5/80.2 mmHg] was high when compared to discharge [114.3/75.19mmHg] within the normal range according to JNC classification 8. A similar study conducted by Akpek M etal showed post-COVID-19 at admission[120.9/78.5mmHg] & discharge[126.5/81.8 mmHg] was high . Which may be little high in when compare to our findings. The corticosteroids usage in patients with COVID-19 infection in our study may show the reduction in the BP. (13)

In this study the mean respiratory rate(RR), Heart Rate (HR),Temparature, saturated partial pressure of oxygen(SPO2) in these study at admission and discharge was 21.75cpm and 20.41cpm; 84.18bpm and 79.48bpm ; 98.76° : 95.17% and 96.77% respectively which is higher when compare with study conducted by Caruso PF et al., the mean RR was 18cpm: 79 bpm: 96.8°F : SPO2 (96%). (11)

The most commonly preferred positivity conformity test for COVID 19 was RT-PCR, used in 151(97.42%) in our study. Rapid-RTPCR was used only in 4(2.5%) patients. A study by Thomas Ferte et al. found that RT-PCR was of high specificity and sensitivity when compared to Antigen testing (14).

The patients were divided into mild, moderate, and severe, depending upon the laboratory data, x-ray report, and HRCT report. In our study, 118(76.1%) patients were of the moderate category, 20(12.9%) patients were of the mild category, and 17(11.0%) patients were in a severe category. The mild severity patients would get home quarantined, so the admission of mild disease patients was reduced.

The kidney and liver function tests performance was observed in this study because of COVID 19 may brings an changes to these enzymes normal values indicate liver dysfunction. The mean of the values of S.Albumin & S Globulin SGOT, SGPT is 3.62 g/dl: 3.5g/dl: 34.66U/l: 51.9U/l . A similar study conducted by Brinati D et al showed the SGOT value 46.6U/l : SGPT value 54.2U/l . (16)

BUN and S.Creatinine values are used to assess kidney function. The mean BUN value obtained in the study was 15.8mg/dl, and that of S.Creatinine was 1.1mg/dl. Both the values are to be within the normal range. Found the abnormal values were in CKD, AKD, pyelonephritis, and PKD patients. Found the values of electrolytes were lie between the normal ranges.

The patient Complete Blood Count (CBC) values helps to decide the severity of the disease. The hemoglobin values were similar during admission and discharge, i.e., the mean value was 13.5g/dl. Generally, during COVID-19, the hemoglobin values are reduced due to altered iron homeostasis. The mean of the WBC count & platelets was obtained during admission & discharge 7520.3 cells/cumm, and 8578.9 cells /cumm : 2.7 lakhs/cumm and 3.03 lakhs /cumm respectively—found thrombocytopenia and thrombocytosis in patients with the infection. (15)

A similar study conducted by Brinate D et al. showed the mean of platelets was 2.26 lakhs/cumm. Both leucocytosis and leucopenia are encountered in COVID-19 infection. (15,16) The lymphocyte counts are found to reduce during the early disease. The mean lymphocyte count during admission was 20.69%, and at discharge,27.57%. The values of Neutrophils are increased in the infection. The mean of Neutrophil count was 76.12% [admission] and 65.56% [discharge].

D-Dimer is a by-product of the metabolism of fibrinogen in the blood helps to detect the blood clots and it is the one of the gold standard test . C reactive protein (CRP) is a protein synthesized by the liver in response to inflammation. The mean of the D-Dimer , CRP value was during admission , at discharge was 1664.7ng/ml: 50.45mg/l & 613.86ng/ml: 41.97mg/l in our study . Hema K etal similar study showed the D Dimer and CRP values are 1017ng/ml: 54.32mg/dl. (5)

Out of 155 patients, 129(83.2%) recovered completely from COVID19 infection. Gradually, reduced the symptoms, and the consecutive RT-PCR reports were negative. The patients were discharged later. 12(7.7%) patients were advised for home quarantine and reduced The symptoms & negative RT-PCR report. The patient was discharged under caution. 14(9.0%) patients were transferred to other hospitals. The transfer may be due to financial issues of the patient as it was a tertiary care hospital

The COVID-19 treatment protocol includes antibiotics, antivirals, anthelmintics, vitamin supplements, blood thinners, and supportive medications to treat COVID-19 infection. Antibiotics were widely used for the treatment of COVID-19 infection. The most widely used antibiotic was Ceftriaxone (60.6%), followed by Azithromycin (59.4%). These are the two antibiotics were widely used in the treatment of COVID-19 infection in the first wave. Doxycycline (34.8%) and Linezolid (5.8%) were extensively used to treat COVID-19 infection in the second wave. Other antibiotics like Piperacillin tazobactam(20.6%), Clindamycin(1.3%), Cefoperazone-Sulbactam(10.3%), Meropenem(3.9%), Teicoplanin(0.6%), Vancomycin(0.6%) and Polymixin B(1.3%) were the other antibiotics used to treat COVID-19 infection in our study . A similar study conducted by Hema K etal in their multi centric study showed the various antibiotics are Doxycyline (75.6%) followed by Piperacillin-Tazobactum(67.8%), Ceftriaxone(20.5%), Meropenem(12.32%), and the least used antibiotic was cefotaxime and Cefipime-Tazobactum(0.006%). (5)

Another study carried out by Feng Sun et al. in China showed Moxifloxacin(98.8%), followed by CeftriaxoneTazobactum(38.2%), Cefoperazone-Tazobactum(20.6%), and Cefoperazone Sulbactam(20.0%). (6)

Another study conducted by Brahmantya IB etal in Indonesia showed azithromycin (34.7%) was more when compare with other catgeroy of drugs . (7)

Antivirals are the most important component of the COVID-19 treatment protocol which was observed 77.4% in our study. The three most commonly used antivirals are Oseltamivir,

Favipiravir, and Remdesivir. Oseltamivir inhibits the neuraminidase enzyme, which is expressed on the viral surface. This enzyme is found to help in the movement of the virus in the respiratory tract. Favipiravir is a broad-spectrum inhibitor of viral RNA polymerase. RNA polymerase is an enzyme required for RNA production and helps in viral replication. Remedesvir, in its active form, acts as a nucleoside analog and inhibits the RNA polymerase of the SARSCoV-2. Oseltamivir was the most widely used antiviral, in 51.6% patients, followed by Remdesivir, 41.3% patients, and Favipiravir 12.3% patients in our 155 study patients. Lopinavir /Ritonavir, Arbidol and Ribavirin were not used in our hospital to treat Covid-19 infection.

A similar study conducted by Hema K etal in their multi centric study showed the various antivirals are Remdesivir 26.71 % was the most prescribed antiviral, followed by Oseltamivir 13% , Favipiravir 0.027%, and Ulinastatin 0.013%. (5)

Another study carried out by Feng Sun et al. in China showed Oseltamivir 75.8% followed by Interferon 43.0% , Lopinavir/Ritonavir 13.9% , Arbidol 8.5% and Ribavirin 1.8%. (6)

Ivermectin was the only antihelmintic used in the treatment of COVID-19 infection. Ivermectin acts by inhibiting host importin alpha/beta1 nuclear transport proteins, which are a part of a key intracellular transport process. It is also found to interfere with the attachment of spike protein to the human cell. (17) Ivermectin was administered to 29.7% patients. The administration of Ivermectin started during the second wave. Initially, Ivermectin was not administered.

Analgesics were administered to reduce fever as it was the most common clinical presentation during admission. Paracetamol was the most common analgesic used, followed by tramadol. It was administered in both oral and parenteral forms. Corticosteroids were boons in the treatment of COVID-19 infection. Corticosteroids inhibit a pro-inflammatory gene that encodes for chemokines, cytokines, cell adhesion molecules, and the acute inflammatory response. Corticosteroid was used in our study patients was 68.4%. The most commonly used corticosteroid was Dexamethasone, followed by Methylprednisolone. Budesonide was also used as an inhaler in patients complaining of asthma.

A similar study conducted by Hema K etal in their multi centric study showed the various corticosteroids used were Methylprednisolone 50% , Dexamethasone 17.1 %   , and Budesonide 19.1% of patients. (5)

Bronchodilators are widely used in the treatment of COVID-19. They are found to cause dilation of bronchi, thereby increasing the amount of oxygen supply to the lungs. The most commonly used bronchodilators were Levosalbutamol, ipratropium bromide, formoterol, etc In this study only 9% of the patients were used with this .
The most widely used immunomodulator is Hydroxychloroquine. It interferes with the endocytic pathway, blocks sialic acid receptors, restricts pH-mediated spike protein cleavage at the ACE2 binding site, and prevents cytokine storm. Interestingly in our study only 27.1% were given

patients . A review paper by Satarker, S etal showed using of hydroxy chloroquine may helful. (18)

Blood thinners like aspirin, and ticagrelor was administered to patients having co-morbidities like IHD, CAD, and HTN. It was administered to 14.8%   patients. Anticoagulants were extensively used as the COVID-19 infection was found to cause an increase in the viscosity of the blood. Clexane and heparin were used in the treatment of COVID-19 infection. It was prescribed to 72.9% patients in our study.

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Prescribed Antihistamines, Luecotriene antagonist, and Expectorants were to treat cough and cold. The most commonly prescribed antihistamine was Levocitrizine which was given at 5 mg. Leukotriene antagonist was given to reduce mucous production in the respiratory tract. The only leukotriene antagonist prescribed was Montelukast sodium. Expectorants were used in the treatment of wet cough or cough that involves sputum production. Ascoril syrup was used, which had ambroxol, levalbuterol, and guaifenesin as its components. Antiulcer or antacid medications are used to avoid any gastric disturbances caused by the medications used to treat the COVID-19 infection, especially antibiotics and antivirals. Found The most widely used antiulcer medication was Pantoprazole (75%), a proton pump inhibitor that reduces the secretion of acid in the stomach. Ranitidine, a histamine -2 receptor blocker, was given to 9.5% of the patients. It reduces the acid secretion in the stomach by blocking the H-2 receptor in the gastric cells. Sucralfate and milk of magnesia were also prescribed to protect the gastric mucosal layer from damage. Acetylcysteine was the most prescribed mucolytic given to 15.3% of the patients. It decreases the viscosity of secretions, especially the mucous in the respiratory tract in theasse study

A similar study conducted by Hema K etal in their multi centric study by other drugs showed the acetylcysteine was prescribed to 26.7% of the patients. (5)

 From our study, we learned that Diabetes Mellitus and Hypertension are the most common co-morbidities found in the patients admitted for the management of COVID-19. We have seen that corticosteroids are a boon in treating this infection but are found to hurt patients with co-morbidities like DM and HTN. Insulin was used extensively (7.1%) in treating Diabetes Mellitus in Patients with COVID-19. The treatment also included the combination of drugs like metformin, glimepiride, vildagliptin, etc., and insulin. The management of Hypertension in COVID-19 patients involves the use of combinations of drugs. A beta blocker is combined with an ACE inhibitor, ARB antagonist, Diuretic, calcium channel blocker, and centrally acting antihypertensive. Olmesartan 3.1% was widely prescribed for treating hypertension in COVID-19. The most commonly used Beta blocker is Metoprolol, which is a cardio selective blocker. Hypothyroidism is also found to influence the severity of the infection and the number of days of hospital stay. Levothyroxine 8.2% was the most commonly administered ant hypothyroid medication. The dose of Levothyroxine depends on the values of TSH, T4, and T3. Various doses available are 25mcg, 50mcg, 75mcg and 100 mcg. Antiemetics were used to avoid nausea and vomiting in patientss with COVID-19. Ondansetron 12.1% was widely used for the same. It is a 5-HT3 receptor blocker.

The other supportive medications used were Potassium reducing agents (Calcium polycistronic sulphonate- 5.8%), Antiseptic (Betadine gargle-0.6%), Alkalisers(sodium bicarbonate -3.2%), Anti-anaemia ==(Erythropoietin== alpha -0.6%), Thrombolytic (Tenecteplase-0.6%), Laxatives(Lactulose-2.5%) ,and Antifungal(Voriconazole-0.6%).

Pirfenidone is a medication used in the treatment of idiopathic pulmonary fibrosis. It reduces lung fibrosis by down-regulation of the production of growth factors and procollagens I and II (19). It was administered to the most severe patients admitted to ICU and are on mechanical ventilation. The X-ray and HRCT reports of the patients showed extensive patchy consolidations. Diuretics are mainly used to treat hypertension and other cardiac-related issues. A Loop diuretic was commonly used. Furosemide (4.9%) was the most used diuretic followed by Amiodarone (1.2%) and Torsemide (0.6%). Sedatives and Antidepressants were used to treat patients in ICU who were in severe condition. Benzodiazepines were commonly administered to critically ill patients. The majorly prescribed antidepressant was escitalopram. The total mean cost of the medications was Rs.17322.55. This cost includes all the medications used to treat COVID-19 infection, excluding the IV fluids. The costs of medications are found to change from place to place and from hospital to hospital.

Conclusions:

The treatment of COVID-19 includes various medications like antibiotics, antiviral, anthelmintics, immunomodulators, corticosteroids, and other supportive drugs. A Pharmacoeconomics study determines the cost of medications used to treat COVID-19 infection in our study.

The antibiotics were generally used with cell wall synthesis inhibitors (penicillin, cephalosporin's) and protein synthesis inhibitors (Amino glycosides, Macrolides, tetracycline's). The combinations used were Piperacillin/Tazobactam + Azithromycin, Ceftriaxone + Azithromycin, Cefoperazone/Sulbactam + Azithromycin, Ceftriaxone +Doxycycline and Piperacillin/Tazobactam +Doxycycline. Antiviral medications used were Oseltamivir, Favipiravir, and Remdesivir. A loading dose was administered, which was followed by a maintenance dose. The loading dose was twice the maintenance dose. The immunomodulators used were Hydroxychloroquine and Tocilizumab. Hydroxychloroquine was extensively used during the initial phase of the COVID-19 infection.

Corticosteroids administer only to patients who have moderate to severe disease. The choice of corticosteroid depends on the condition of the patient. Tocilizumab, an anti-interleukin 6, was administered to one patient, costing Rs.44,000. Due to cost considerations in COVID-19. The total cost calculated from the study mainly focuses on the medications given to the patient. The study did not include other medical expenses like ward charges and supportive measures. The other supportive medications include antihistamines, antitussives, and mucolytics for treating cough and cold, a major clinical presentation of COVID-19. The treatment protocol followed in our hospital was on par with the ICMR guidelines for the treatment of COVID-19. ==The clinical pharmacist's presence in the management of COVID-19 can help the doctors in rational drug usage promotions like safety and cost minimization.==

Ethical Approval:

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

Limitations of the study:

1. The sample size is small due to six months & limited time to access the medical records department. Hence collected Only 155 cases.
2. There was a lack of laboratory data in the medical records of initial COVID-19 admissions due to the fear of infection by the health care professionals.

Future directions:

➤ The treatment of COVID-19 was regularly changing due to the virus's mutations, and the number of prescribed drugs per patient increased. However, the chances of ADR increased in the patients. Hence the continuation of these studies may be beneficial for further.

➤ The secondary infection studies, like black fungus-associated studies, required further.

➤ Can take antimicrobial resistance studies in these disease conditions <mark>further</mark>.

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