

# Repurposing surgical wards in pandemics – An appraisal of outcomes of COVID-19 patients treated in Orthopaedic wards

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## ABSTRACT

**Background:** The COVID-19 pandemic resulted in a shift in the way healthcare resources were used. While India faced limited effects in the first COVID wave primarily due to strict lockdown of the county, it was one of the worst affected in the second wave and at one time reported the highest number of daily cases. To address the lack of intensive care units (ICU) beds, the surgical wards of our institute were repurposed to take care of patients requiring supplementary oxygen and other supportive care till either they improved or an ICU bed was available. The medical personnel in charge of the surgical wards were entrusted with the care of patients with support from intensive care support teams (ICST). **Aims:** We aimed to examine the clinical details of patients admitted in the repurposed orthopaedic wards during the second COVID wave and to evaluate the factors that might affect the clinical outcomes in such patients. **Methods:** This was a retrospective review of records of patients admitted in the repurposed orthopaedic wards between 16 April 2021 and 20 May 2021. Details related to demography, COVID-19 presentation, COVID-19-related management and clinical course, including transfers to ICUs, and outcomes in terms of either discharge to home or death were recorded. They were analysed using statistical software. **Results:** One hundred and twenty three patients were treated during the said period. Twenty patients died during treatment, resulting in a mortality rate of 16.3%. Age, gender, RT-PCR status, pre-existing comorbidities, SpO<sub>2</sub> at admission, method of supplemental oxygen supply, total leukocyte counts, haemoglobin values, serum C-reactive protein, Lactate dehydrogenase (LDH) and creatinine values had no statistically significant association with death of a patient during treatment. **Conclusion:** Based on the results, one can state that clinicians of surgical specialities having background knowledge of internal medicine from undergraduate education can manage patients of COVID-19 with support from ICST with reasonable outcomes. In case of future pandemics, surgical wards can be repurposed to tide over exigencies. Additionally, primary care physicians, who are often the first point of contact for patients, can allay their apprehensions adequately in future pandemics, thus preventing widespread panic and burdening of healthcare resources.

**Keywords:** Comorbidities, COVID-19, orthopaedic wards, pandemic preparedness, primary care, repurposed wards, triage

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## Introduction

Pandemics like the one caused by severe acute respiratory syndrome coronavirus 2 (SARS CoV-2), commonly known as COVID-19, are believed to be once-in-a-lifetime events.<sup>[1]</sup> The World Health Organization (WHO) declared this outbreak a

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pandemic on 11 March 2020 and ended its status as a public health emergency of international concern on 5 May 2023.<sup>[2-4]</sup> Almost none of the medical professionals had any experience in dealing with pandemics; a way forward was not known, and most countries went into lockdown to slow down and control the spread of virus. India was under complete national lockdown from 24 March 2020 onwards<sup>[5]</sup> A titrated relaxation of lockdown was undertaken based on the cases being identified and the number of deaths reported. The second COVID-19 wave was much more severe than the first one and necessitated restrictions and localised lockdowns in the entire country by mid-May 2021. Very large number of patients contacted primary care clinicians during this wave and visited healthcare facilities, resulting in the healthcare system being put under severe strain.<sup>[3]</sup> This necessitated the implementation of unconventional measures for the efficient utilisation of resources.<sup>[6,7]</sup> Many patients visited the clinicians and hospitals out of apprehension and even hoarded medical supplies.

Our institute suspended all elective services in the first COVID wave. Patients with COVID-19 infection and non-COVID patients with emergencies were being admitted. Our institute was thus repurposed as a COVID-19 facility with a separate COVID-free pathway for emergency care. The strict restrictions imposed in the first wave resulted in a smaller number of patients getting admitted, and the institute was able to handle the patient load with the involvement of intensivists and critical care clinicians.

During the second COVID wave, primary care clinicians were able to guide several patients, but even after that, a very large number of patients visited hospitals. It was realised by our institute's administration that that it was not possible to admit all patients in ICUs, and it was decided to optimise the use of available resources by repurposing the beds with dedicated oxygen points in non-medical wards. As per this new arrangement, all the patients visiting the hospital with symptoms of COVID-19 were screened at the triage created at the emergency department of the hospital. Patients with mild to moderate symptoms were discharged home with supportive treatment with the advice to contact the hospital or their family physicians for any further guidance, while those with severe symptoms were admitted to different wards depending on bed availability, where the health professionals of the respective wards managed them with support from the Department of Anaesthesia and Critical care. The patient movement was dynamic and depended on the availability of beds. Patients needing intensive or specialised care were shifted to the various intensive care units (ICUs)/high dependency units (HDUs), and those who had recovered in the ICUs/HDUs were shifted to the repurposed wards for step-down care. The orthopaedic wards were also repurposed and were managed by the orthopaedic surgeons and nursing staff of the wards.

We conducted this study intending to assess (a) the clinical details of the patients admitted in the repurposed orthopaedic wards, (b) the clinical course of these patients in terms of transfer

to ICU or discharge to home as an indicator of improvement and deterioration, and (c) the rate of mortality of the patients admitted in the orthopaedic wards. The research question guiding this study was based on the premise that the clinicians with surgical backgrounds would be able to support the intensive care and medical departments by directly managing patients during pandemics in case the healthcare facilities are overwhelmed by the number of patients.

## Methods

### Study design

Approval from the Institutional Ethics Committee (IHEC) was obtained for this retrospective observational study (IHEC-LOP/2021/IM0396). A waiver of consent was obtained to use anonymised data of the patients. Medical records of all patients admitted in the repurposed orthopaedic wards between 16 April 2021 and 20 May 2021, either directly from triage or after being transferred from an ICU/HDU, were retrieved for data collection, and evaluation. None of the patients were excluded.

Demographic details, including comorbidities, details related to COVID-19, the symptoms and clinical parameters related to the course of the disease, laboratory investigations and those related to the outcomes were collected. These were entered into a Microsoft Excel spreadsheet, screened, and verified to avoid missing out on the details. Further analysis was performed using the statistical functions of Microsoft Excel and SPSS ver. 26 (IBM, Armonk, NY).

### Ward Repurposing arrangements

The faculty of internal medicine managed the triage services in the emergency area with the support of registrars and residents of their department. All patients with symptoms of COVID-19 like fever, cough, breathing difficulty, loss of smell, muscular pains, headache, abdominal symptoms, and others with or without a recent RT-PCR or Rapid Antigen test were evaluated clinically, and their oxygen saturation (SpO<sub>2</sub>) was measured using pulse oximeters. Those with SpO<sub>2</sub> of more than 90% were considered for domiciliary care with supportive medications for symptomatic relief of symptoms; general measures like adequate fluids, a nutritious diet and isolation were suggested. Samples for RT-PCR were collected. They were advised to check their temperature and oxygen saturation at regular intervals and contact their family physician or the emergency department if the SpO<sub>2</sub> fell below 90%, or had a temperature more than 100°F or their symptoms worsened.

Patients who had SpO<sub>2</sub> less than 90% were further clinically evaluated in detail and admitted for in-patient care. Patients who needed emergency intubation in the triage area were preferably shifted to an ICU, if a bed was available or to the wards of internal medicine and allied specialities like Pulmonary Medicine, Nephrology, Neurology, Endocrinology and Cardiology

departments. Patients with comorbidities, those requiring high-flow oxygen, were preferably admitted to HDUs of Internal Medicine. Patients without a need for high-flow oxygen and those without comorbidities were admitted to repurposed wards of surgical specialities. While this was the proposed scheme in case any patient needing admission into an ICU or HDU failed to get admitted there, they were also admitted in the repurposed wards too.

The orthopaedic staff – doctors, nurses and support staff managed the repurposed orthopaedics wards. One consultant, two registrars, and three residents were posted for each ward per shift with a schedule of two shifts per day (day –9 AM to 9 PM, and night –9 PM to 9 AM). The nursing and support staff worked in three shifts. Management in the ward involved monitoring vitals providing supportive medications like acetaminophen, ibuprofen, anti-tussive agents, etc., based on the requirement. Oxygen support was provided using a facemask, nasal prongs, non-rebreather mask (NRBM), and non-invasive ventilation using a Bain circuit depending on the ability of the patient to maintain SpO<sub>2</sub> of more than 90% with the least invasive method of supplementation. Injectable drugs like methylprednisolone, antibiotics, low molecular weight heparin and remdesivir were administered based on the patient’s overall condition, change in the condition after being admitted, and the pre-existing comorbidities.

Intensive care support teams (ICST) comprised an intensive care consultant, a registrar, and two residents who provided support by participating in combined rounds with the orthopaedic team. Decisions for changing the mode of oxygen delivery, modifying drugs, and seeking transfer of a patient to an ICU or HDU were made during the rounds. The team provided support for intubation in the ward. The status of the patients and their prognosis were conveyed on a regular basis to the caregivers by the orthopaedic team, with the ICST pitching in for those with poor prognosis. The clinical course was determined by an improvement or deterioration of the symptoms and an increase or decrease in the oxygen requirement. Patients were discharged if they had significant improvement in symptoms and maintained SpO<sub>2</sub> of more than 90% on room air.

## Results

The repurposing of orthopaedic wards as dedicated COVID facilities lasted for 36 days. A total of 123 patients were admitted to the orthopaedic wards, including those who were admitted directly from triage and those who were transferred from an ICU/HDU. Of these, 45 patients (36.6%) were females. The mean age was 52 years (SD 14.65). The youngest patient was 21 years old, while the oldest was 87 years old, both of whom were males. The mean age of the females and males was 55.4 and 50.1 years, respectively. Most of the patients (78/123) were residents of areas that were within 30 kilometres of the hospital. Comorbidities like hypertension, diabetes mellitus, Coronary artery disease, asthma, and others were present in 67 (54%)

patients. Fifty-six patients had no pre-existing comorbidities. Hypertension was the most common pre-existing comorbid condition seen in 60 patients. Table 1 summarises these details.

Table 2 provides an insight into the COVID-19-related parameters. The most common presenting symptom was breathlessness followed by cough. No patient presented with anosmia in this COVID-19 wave. Fever was not present in most patients. RT-PCR was found to be positive in 109 patients, and respiratory distress was present in 117 patients. While the heart rate, Total leucocyte count and haemoglobin levels were not raised at the time of admission, C-reactive protein (CRP) and lactate dehydrogenase (LDH) levels were raised significantly. 17 patients had a very high requirement of supplemental oxygen and were candidates for ICU/HDU care, but in view of the non-availability of beds, they were admitted to the orthopaedic ward. These patients were supported by non-invasive ventilation with a Bain circuit. All the patients were administered intravenous steroids, and the majority (120/123) received anticoagulants.

One hundred three patients improved and were discharged; however, 20 patients could not be saved. Thus, the case fatality rate was 16.3%. The mean stay of the patients in the orthopaedics ward was 9.3 days, and the overall mean stay in the hospital was 11.2 days.

When further analysis was performed using Chi-square test and independent samples ‘t’ test, it was observed that the variables like gender, age, RT-PCR status, pre-existing comorbidities, the mean SpO<sub>2</sub> at the time of admission, mean CRP and LDH level,

**Table 1: Basic details of the patients admitted in the repurposed orthopaedic wards**

Parameter	Number (n)	Percentage (%)
Gender		
Male	78	63.4
Females	45	36.6
Age (years)		
20-39	30	24.4
40-59	49	39.8
60 and above	44	35.8
Distance from hospital		
<30 kms	78	63.4
>30 km	45	36.6
Pre-existing comorbidities		
Yes	67	54
No	56	46
Medications for the comorbidities (n=67)		
Yes	63	94%
No	4	6%
Details of pre-existing comorbid conditions		
Hypertension	60	48.8
Diabetes mellitus	49	39.8
Asthma	4	3.3
Coronary artery disease	4	3.3
Others	4	3.3

**Table 2: Clinical details of the patients related to COVID-19**

Parameters	Number (n)/mean	Percentage (%)
Symptoms present at the time of admission		
Breathlessness	113	91.9
Cough	103	83.7
Fever	34	27.6
Weakness	9	7.3
COVID-19 RT-PCR		
Positive	109	88.6
Negative	14	11.4
Respiratory distress at admission		
Yes	117	95.1
No	6	4.9
Mean heart rate at the time of admission	93.3 (SD 11.89) beats per minute	
Mean CRP at admission	83.3 mg/dl (SD 67.12)	
Mean serum LDH at admission	366.743 (SD 116.15)	
Mean TLC count	9690/mm <sup>3</sup> (SD 7757)	
Mean Haemoglobin level	12.13 g/dL (SD 1.73)	
Mode of oxygen delivery at the time of admission to the ward		
Room air	10	8.1
Face mask	23	18.7
Nasal prongs	16	13
NRBM	57	46.3
NIV with Bain circuit	17	13.8
Use of intravenous methylprednisolone		
Yes	123	100
No	0	0
Remdesivir use during treatment		
Yes	2	1.6
No	0	0
Anticoagulant use during treatment		
Yes	120	97.6
No	3	2.4
Outcome		
Discharge to home	103	83.7
Death	20	16.3
Mean length of stay in the orthopaedic ward (days)	9.3 (SD 4.5)	
Mean length of stay in the hospital (days)	11.2 (SD 5.8)	

mean Total Leukocyte Count (TLC), haemoglobin level, the mode of oxygen delivery at the time of admission, and the duration of hospital stay were similarly distributed among the patients who were finally discharged to their homes and who succumbed in the hospital. Those who had a requirement for ICU/HDU care based on their clinical condition, as indicated by the consideration given for ICU transfer, had a significant association with mortality. These details are summarised in Table 3.

## Discussion

The proverb ‘desperate times call for desperate measures’ was proven true during the COVID-19 pandemic, which resulted from the rapid spread of the SARS-CoV-2 virus after the index case was detected in Wuhan.<sup>[1,3,8]</sup> Severe and multisystemic nature of the infection necessitated requirement of intensive care management in most patients in the first wave. Measures like repurposing of hospitals to COVID care facilities, creating

dedicated COVID facilities, creation of new ICUs, training of non-intensivists to manage ICUs, and rationalisation of resources were undertaken.<sup>[6-12]</sup> Clinicians with surgical background like orthopaedic surgeons pitched in by performing non-core speciality functions like prone positioning.<sup>[13]</sup> Guidelines for management of patients in non-intensive care setting in general medicine and pulmonary medicine wards were provided.<sup>[2]</sup> All these combined efforts led to tiding over of the first COVID wave and a gradual reopening of the economic activities across the world.

Subsequently, numerous COVID-19 models were created for hospital surge capacity planning aiming to better equip health care facilities for any future COVID waves or other pandemics.<sup>[14]</sup> However, even with multiple modelling studies no one was prepared for the unexpected surge in COVID cases in the second COVID wave.<sup>[15,16]</sup> This overwhelmed the healthcare system, and severe shortage of ICU beds, beds with oxygen

**Table 3: Comparison of distribution of different variables between the patients who were discharged and those who died**

Variables	Discharge	Death	P
Gender			
Male	69	9	0.07*
Female	34	11	
Age (years)			
20-39	26	4	0.86*
40-59	41	8	
60 and above	36	8	
RT-PCR status			
Positive	91	17	0.71*
Negative	12	3	
Pre-existing comorbidities			
Yes	54	49	0.37*
No	13	7	
Mean SpO <sub>2</sub> at the time of admission (SD)	89.09 (5.19)	87.7 (8.13)	0.33 <sup>#</sup>
Mean heart rate at the time of admission (SD)	93.3 (11.06)	92.9 (15.8)	0.85 <sup>#</sup>
Mean CRP at admission (SD)	82.13 (69.9)	89.7 (50.6)	0.66 <sup>#</sup>
Mean LDH at admission (SD)	362.8 (114.1)	386.5 (127.2)	0.42 <sup>#</sup>
Mode of oxygen delivery at admission			
Room air	8	2	0.97*
Face mask	20	3	
Nasal Prongs	14	2	
NRBM	47	10	
NIV with Bain circuit	14	3	
Was a transfer to ICU/HDU considered			
Yes	37	13	0.01*
No	66	7	
Was the patient transferred out?			
Yes	20	6	0.75*
No	17	7	
Mean duration of stay in orthopaedic ward (days)	9.26 (4.11)	9.25 (6.25)	0.99 <sup>#</sup>
Mean duration of stay in hospital (days)	11.10 (5.23)	11.75 (8.13)	0.64 <sup>#</sup>

\*Statistical test used was the chi-square test, and 'two-tailed' significance value was considered. <sup>#</sup>Statistical test used was independent samples t-test

support and even clinicians for managing the patients was faced.<sup>[3,16]</sup> Consequently, combined with the guidelines released by the government of India, the health facilities improved and came up with management options at the local levels. Taking a cue from the repurposing of non-ICU, the creation of rapid response hospitals, remote home monitoring and virtual beds in a combined and integrated way, the management of our institute repurposed the wards of surgical specialities.<sup>[6,7,10,12,17,18]</sup> As per this system, patients with SpO<sub>2</sub> more than 90% were to be managed at their homes with constant support and guidance of primary care physicians and were to be admitted only if their condition worsened. The remote home monitoring/virtual bed system had shown great promise in reducing the burden on the healthcare system and was logically taken forward. The repurposing of surgical wards was planned based on the idea that the undergraduate medical course in India with the mandatory internship is biased more towards general medicine, and all faculty, registrars, and residents had a basic knowledge of management of patients with respiratory symptoms. Additionally, ICSTs were created to support the decision-making process of the surgeons and to aid in co-ordinating with ICUs/HDUs for transfer of patients.

This retrospective study aimed to analyse the success or failure of this exercise of repurposing surgical wards in case of overburdening of the healthcare system during pandemics. The primary outcome was either a discharge of the patient after improvement or death. Based on the analysis of the results, one can draw the below-mentioned inferences –

- More male patients were admitted than females, and middle-aged patients (40 – 59 years) were the most frequent to need admission. An almost equal number of patients with or without a pre-existing comorbidity needed admission.
- Breathlessness was the most common symptom.
- The mortality rate was 16.3%. The patients who succumbed did not differ significantly from those who improved in terms of age, gender, presence of comorbidities, SpO<sub>2</sub>, TLC, platelets, haemoglobin level, serum CRP and LDH values at admission.

Porto *et al.*<sup>[11]</sup> reported the Brazilian experience of managing patients during the COVID waves. Similar to our study, they reported the affection of a relatively younger population in the second wave. They found hypertension and diabetes

mellitus to be the two most frequent comorbid conditions and that dyspnoea, cough and fever were the most common symptoms. While they reported a positive association between in-hospital death and age, lower SpO<sub>2</sub> and quick SOFA score, we did not find a statistically significant association. The overall in-hospital mortality rate in their study was around 41%. AlGhawi *et al.*<sup>[19]</sup> reported the mortality patterns of two hospitals in Saudi Arabia. Their results showed that Diabetes mellitus was more common than hypertension; fever was a more common symptom than shortness of breath. Corradini *et al.*<sup>[8]</sup> reported the results of COVID-19 patients treated in the Internal Medicine Unit wards in Italy during the first COVID wave. Italy was one of the worst affected nations during the first wave, not unlike India during the second wave. They reported a mortality rate of 21.7%. They noted an increased mortality rate among males, and with increasing age, in patients with congestive heart failure and COPD. They have reported that 310 of the 697 patients (44.5%) who were transferred to ICU succumbed. In this study, we noted the rate of mortality among those transferred to ICU as 23% (6 out of 26). Of those who needed ICU care but could not secure a bed due to unavailability at that time, the mortality rate was 29%. There were seven deaths (9.5% mortality rate) due to unanticipated deterioration among the 73 patients in whom a consideration for ICU transfer was not there. Moledina *et al.*<sup>[20]</sup> reported on the mortality of patients occurring in ICU care. They concluded that increasing age, increased requirement of FiO<sub>2</sub> at admission, and raised creatinine and urea levels were associated with increased mortality. However, we did not find an association between creatinine level and mortality. Van der Veer *et al.*<sup>[21]</sup> reported an overall mortality rate of 29% in patients admitted in non-ICU wards. When considered separately, the do not intubate group (DNI) of patients had a mortality rate of 49%. While DNI might be an option in many societies, it is not a frequent option in India. Additionally, the choice to allot an ICU bed preferentially to a potentially salvageable patient is an often debated one.<sup>[12]</sup>

While this study has presented results of COVID-19 patients Orthopaedists in repurposed orthopaedic wards, there are a few shortcomings. The study sample is small, several other detailed data as captured in previous studies were not captured, statistical analysis is simplistically presented, and detailed analytical tools and modelling methods that might probably have provided greater details were used. However, the aim was to reach out to readers, especially to primary care physicians and surgeons, to impress upon the possibility of repurposing surgical wards at times of exigencies, and we believe that reasonable success with a controlled mortality rate can be considered as a favourable outcome of the study. The primary care clinicians, who are often the point of first contact for most patients, can allay their apprehensions and thereby help control the footfall of anxious patients in overburdened hospitals in future pandemics. The unchallenged importance of primary care physicians has also been emphasised by Kumar *et al.*<sup>[22]</sup>

## Conclusion

In situations where ICU bed availability might be an issue, one can follow the arrangement of repurposing surgical wards if the need arises. To better prepare for future pandemics, irrespective of the final speciality of choice, each student of medicine should have adequate knowledge of internal medicine at the undergraduate level and refresher courses must be organised for all practising clinicians including primary care physicians and surgeons at regular intervals.

## Patient consent

The consent was waived off by the IHEC as it involved use of hospital records without any sort of disclosure of the patients' identity.

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## Conflicts of interest

There are no conflicts of interest.

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