Short Report

Experience with SARS-CoV-2 in an orthopaedic hospital

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SUMMARY

Background: Concerns about nosocomial transmission of SARS-CoV-2 have been described since the COVID-19 pandemic was first reported and cases of hospital-acquired (HA) COVID-19 and COVID-19 outbreaks have been reported even in clinical areas not intended for the specific care of COVID-19 and declared as “non-COVID” areas.

Methods: Retrospective analysis of measures to prevent hospital acquisition of COVID-19 in patients admitted to a tertiary referral specialist orthopaedic hospital in Brazil in which emergency care was maintained during the pandemic.

Results: The proportion of HA-COVID-19 (0.07%) was lower than the value reported for general healthcare in Brazil (0.72%, P < 0.001). The integration of several clinical teams to maintain a constant surveillance system, as well as the immediate isolation of patients with any compatible symptoms of COVID-19 and the restriction from work and the testing of symptomatic healthcare workers, were an important part of the strategies adopted.

Conclusion: We suggest that the described strategies for preventing the nosocomial spread of SARS-CoV-2 contributed to the observed proportion of HA-COVID-19 to be significantly lower than the reported national value. Future studies that investigate these and other preventative measures are important so that hospitals are prepared for further periods of a high incidence of COVID-19, as well as for other epidemics associated with respiratory transmission.

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Introduction

COVID-19 caused by the SARS-CoV-2 virus was first described in December 2019 and declared a pandemic by the World Health Organization in March 2020 [1,2]. Since the initial reports of COVID-19, concerns about its nosocomial transmission have been described, even in clinical areas not specifically intended for the care of patients with COVID-19, and declared “non-COVID” areas [3–6]. For this reason, guidelines have been developed and different strategies implemented for preventing the spread of SARS-CoV-2 in healthcare facilities [7,8]. In Brazil, the notification of cases of SARS-CoV-2 infection has been compulsory since the start of the COVID-19 pandemic, and in August 2020, additional notification of cases of nosocomial transmission of SARS-CoV-2 was instituted [7]. The aim of this study is to describe the measures implemented for the prevention of nosocomial transmission of SARS-CoV-2 in a tertiary referral specialist orthopaedic hospital in Brazil and to evaluate its effectiveness by comparing the local data with published national data for the period from August 2020 to September 2021 [7].
Methods

Setting

The Institute of Orthopaedics and Traumatology (IOT) is part of the Hospital das Clínicas complex linked of the University of São Paulo Medical School, and is a tertiary orthopaedic hospital with 100 operational beds. The hospital has an Emergency Room, five inpatient wards with two patients per room and an intensive care unit (ICU) with eight beds in the same area and 1 isolation bed with negative pressure, in addition to an Operating Theatre suite (OT) with 11 rooms. Only patients with a clinical indication for respiratory precautions are accommodated in single rooms. Between March and September 2020, IOT also admitted patients from other sectors of the hospital complex (neurology, rheumatology, internal medicine, infectious diseases and palliative care) as a “non-COVID area”, so that these clinical areas could be dedicated to the care of patients with COVID-19, given the high numbers of COVID-19 cases. Elective surgery was suspended, but orthopaedic emergency care, including surgery, was maintained without restrictions.

Study type and period

Retrospective analysis of data following the interventions from August 2020 to September 2021 and comparison with information published by the Brazilian national healthcare surveillance authority (ANVISA) was performed [7].

Measures to prevent the intra-hospital spread of SARS-CoV-2

In August 2020, measures for hospitalised patients were already implemented and comprised: the mandatory use of surgical masks during the first five days of hospitalisation; the suspension of visiting; the limitation of an accompanying family member for a patient to those cases provided for by Brazilian law (patients under 18 or over 65 years of age and/or disabled). Initially, only patients transferred from other services underwent RT-PCR screening for SARS-CoV-2 at admission. For the other patients, testing was performed only in the presence of symptoms compatible with COVID-19. In December 2020, with the greater availability of RT-PCR tests, this criterion was modified and all hospitalised patients began to be tested for SARS-CoV-2 on admission and a dedicated ward was created for patients with COVID-19. Until then, patients remained under contact and respiratory precautions for aerosols in a single room in wards.

In this department, it was not possible to create specialised ventilation systems with negative pressure due to the structure of the hospital. Patients were always admitted to single rooms and hand hygiene and environmental cleaning measures, as well as other measures to prevent nosocomial infections, were reinforced and all patients in this clinical area were under contact and respiratory precautions.

During the entire study period, patients with COVID-19 who needed surgery were operated on via a segregated pathway which included transport to the OT without any contact with other patients and recovery in an isolated surgical room until endotracheal tube removal. The operating room designated for these cases was specific for COVID-19 patients and had a laminar flow ventilation system. If transfer to the ICU was necessary, transport was carried out with the same precautions and the patient was isolated in a single room.

Regarding healthcare workers (HCW), the use of surgical masks was mandatory throughout the shift, and the use of N95 masks in the OT and ICU was recommended. All hospital staff were trained in the correct use of personal protective equipment (PPE) and there was no shortage of such equipment at any time. Meals or snacks were only allowed in the cafeteria and acrylic barriers were installed to prevent person-to-person contact. The minimum distance of 1.5 m was mandatory in all communal areas of the hospital and in-person meetings were suspended. HCW with any symptoms compatible with COVID-19 were immediately removed from work and tested with an RT-PCR test for SARS-CoV-2 when they had at least 48 hours of symptoms and restricted from work for 14 days if the result was positive.

Surveillance of suspected and confirmed cases of COVID-19

Nursing staff were trained to consider as a suspected case of COVID-19 any patient who presented with at least one symptom compatible with this infection, even with low clinical suspicion. These patients were immediately kept under contact and respiratory precautions in a single room, and the collection of a swab for RT-PCR for SARS-CoV-2 was mandatory. As of December 2020, these patients were immediately transferred to the designated area for patients awaiting RT-PCR results for SARS-CoV-2. For patients with less than 48 hours of symptoms, in the case of a negative result, isolation precautions were maintained and a repeat sample for RT-PCR was collected within 48 hours.

Twice a day, a surveillance report was generated to update and review the results of all patients with suspected or confirmed COVID-19. Laboratory staff notified any RT-PCR for SARS-CoV-2 collected. The hospital infection prevention and control team was responsible for generating the report every day of the week, including weekends and public holidays, and supervised the isolation precautions implemented.

Patients who had signs and symptoms consistent with COVID-19 within the first 5 days of hospitalisation were considered as community-acquired (CA) COVID-19 cases. Patients who developed signs and symptoms after 6–13 days of hospitalisation were considered as cases of possible hospital acquired (Possible HA-COVID-19). Patients who developed signs and symptoms after 14 or more days of hospitalisation were considered as confirmed cases of HA-COVID-19. The same definitions were used for asymptomatic patients with a positive PCR result for SARS-CoV-2 [7].

All contacts (both patients and HCW) of patients who had developed possible HA-COVID-19 and confirmed HA-COVID-19 had an RT-PCR test for SARS-CoV-2, even if asymptomatic and remained isolated or in the case of HCW restricted from work until the test result.

COVID-19 vaccination

In January 2021, COVID-19 vaccination of HCW in Brazil commenced, and our hospital was the first in Brazil to make the vaccine available to its employees. As of February 2021, 981 employees (89.2% of the total) were vaccinated with
CoronaVac (Sinovac Life Sciences, Beijing, P.R.C) an inactivated COVID-19 vaccine, in a two-dose regimen with a four-week interval.

COVID-19 vaccination of the general population began in February 2021. Four different vaccines were available in the country: CoronaVac (Sinovac), Pfizer/BioNTech BNT162b2, Oxford/AstraZeneca ChAdOx1-S and Janssen Ad26.COV2.S. In the city of São Paulo, where our hospital is located, 79% of the population over 18 years of age (adult population) were fully vaccinated (2 doses or a single dose in the case of the Janssen Ad26.COV2.S vaccine) by September 2021. At that time, 100% of the adult population and 96% of the population aged 12 to 17 had received at least one dose of the vaccine. Only the Pfizer/BioNTech BNT162b2 vaccine was administered to the population under 18 years of age [8].

Measures to prevent intra-hospital transmission of SARS-CoV-2 and surveillance are summarised in Table I.

### Data analysis

The following data were analysed for the period from August/2020 to September/2021: monthly numbers of admissions and discharges; length of hospital stay in days and the number of patients who remained hospitalised for more than 14 days each month (as they are the population at risk of acquiring HA-COVID-19). Demographics and the main reasons for hospital admission were also assessed. The proportions of community-acquired (CA), possible-HA-COVID-19 and confirmed HA-COVID-19 cases were calculated by dividing the number of patients with COVID-19 by the number of discharges and multiplied by 100. The proportion of HCW with suspected and confirmed COVID-19 in the same period was also evaluated.

The proportion of HA-COVID-19 patients observed in this period was compared with the reported national data [7] using the chi-square test (5% significance level).

### Results

During the period observed, the main reasons for hospital admission were severe fractures resulting from road traffic injuries, traumatic amputations of limbs with indication for reimplantation and complex spinal injuries. The age of the admitted patients ranged from zero to 103 years (mean 44, median 43) and there was a predominance of male patients (61.5%).

In total, there were 3950 admissions (mean 282.1 admissions/month) and 4028 discharges (mean 287.7 discharges/month). During this period, the mean length of stay of patients in the hospital was 6.3 days (median of 6 days) and, on average, 32 patients each month remained hospitalised for more than 14 days. The hospital staff comprised 1100 people, with 552 (50.1%) having some symptoms suggestive of COVID-19 at some point during the observed time period. All those who were symptomatic underwent RT-PCR for SARS-CoV-2 and infection was confirmed in 73 (6.6%).

In the period observed in this study, 39 patients admitted at the hospital had CA-COVID-19 (0.96%). Three patients had possible HA-COVID-19 (0.07%) and three patients had confirmed HA-COVID-19 (0.07%). This proportion of confirmed HA-COVID-19 was significantly below the value reported for general units in Brazil (0.07% x 0.72%, P<0.001).

Figures 1 and 2 demonstrate the monthly distribution of admitted patients, including stays longer than 14 days, the numbers and proportions of CA, Possible-HA and confirmed HA-COVID-19 patients and the proportion of HCW with suspected and confirmed cases of SARS-CoV-2 infection.

### Discussion

The prevention of nosocomial transmission of SARS-CoV-2 is challenging, especially due to the long incubation period of the

### Table I

| Inpatients                                                                 |
|---------------------------------------------------------------------------|
| Mandatory use of surgical masks during the first five days of hospitalization |
| Suspension of in-person visits                                             |
| Limitation of accompanying family members                                 |
| Daily screening of all patients for the presence of signs or symptoms compatible with SARS-CoV-2 infection and immediate isolation in the presence of any alteration, even with low clinical suspicion |
| Mandatory collection of swab sample for RT-PCR for SARS-CoV-2 for any symptomatic patient, even with low clinical suspicion |
| Segregated pathway for COVID-19 patients with need for urgent surgery |
| Surveillance census conducted twice daily to monitor results of all RT-PCR for SARS-CoV-2 samples collected, supervision of suspected/confirmed cases and guidance on isolation precautions |
| RT-PCR screening for SARS-CoV-2 for all admitted patients^a               |
| Creation of separate wards for patients awaiting admission^a RT-PCR for SARS-CoV-2 and for patients with confirmed COVID-19^a |

| Healthcare workers(HCW)                                                                                            |
|-------------------------------------------------------------------------------------------------------------------|
| Mandatory use of surgical or N95 masks                                                                           |
| Meals/snacks only allowed in the cafeteria, with acrylic barriers installed to prevent people-to-people contact |
| Minimum distance of 1.5 m mandatory in all areas of conviviality                                                  |
| Suspension of in-person meetings                                                                                 |
| Immediate leave from work in case of any symptoms compatible with COVID-19                                       |
| RT-PCR collection for SARS-CoV-2 from all symptomatic HCW after 48 hours of symptom onset                         |
| 14-day leave from all HCWs with confirmed infection                                                              |
| Vaccination with 2 doses of CoronaVac in a two-dose scheme with four-week interval in January and February/2021 |

^a Started in December 2020.
virus and the high proportion of individuals with mild symptoms or asymptomatic [1,4,10]. In Brazil, which was especially affected by the circulation of the gamma variant of the virus during the period of this study, the reported rate of patients with HA-COVID-19 ranged from 0.72% in general units to 5.86% in ICUs [7,9].

In our hospital, whose orthopaedic emergency care remained active throughout COVID-19 pandemic, the measures taken to prevent nosocomial transmission of SARS-CoV-2 seemed to be effective, as the incidence of confirmed HA-COVID-19 was significantly below the national value. Regarding possible-HA-COVID-19 cases, there are no national data for comparison, but the proportion was also low (0.07%). Despite the presence of admitted patients with CA-COVID-19 as well as HCW with this infection, likely reflecting the high community transmission of the virus, it was possible to contain the spread of the virus to hospitalised patients. The integration of several teams, especially nursing, laboratory and infection control, to maintain a constant surveillance system for suspected and confirmed cases of COVID-19, as well as the immediate isolation of patients with any compatible symptoms and the removal from work and testing of HCW with any symptoms, have already been described as effective in containing the spread of the infection [1,4,10–12]. The high adherence of the hospital staff to vaccination against COVID-19, as well as the high adherence of the population in the area where the hospital is located, may also have contributed to this positive result, especially in the period after January 2021.

This study has some limitations. There was no post-discharge surveillance strategy to detect patients who might have acquired the infection while hospitalised but with onset of symptoms after discharge. However, the mean and median length of stay were around 6 days and, as the median time for the onset of symptoms of COVID-19 is 5–6 days, most patients who acquired the infection while hospitalised would start manifestations of symptoms before hospital discharge. The vaccine status of patients in relation to COVID-19 was not evaluated for admissions that occurred after January 2021, when these vaccines became available in Brazil. However, the hospital is located in an area with a high population adherent to vaccination until September 2021, when the period observed in this study ended.

Figure 1. Monthly distribution of the number of patients admitted and the number of patients hospitalised for 14 days or more (bars, left axis). Monthly distribution of CA-COVID-19, possible-HA-COVID-19 and confirmed HA-COVID-19 cases (lines, right axis).

Figure 2. Monthly distribution of the proportion of healthcare workers (HCW) with suspected and confirmed cases of SARS-CoV-2 infection (bars, left axis). Monthly distribution of the proportion of CA-COVID-19, possible-HA-COVID-19 and confirmed HA-COVID-19 cases (lines, right axis).
Conclusions

The strategies for preventing the nosocomial spread of SARS-CoV-2 described in this study were associated with the observed proportion of confirmed HA-COVID-19 to be significantly lower than the national average during the same period. Future studies that compare these and other prevention measures will be important so that hospitals are prepared for further periods of a high incidence of COVID-19, especially with regard to new variants of SARS-CoV-2 that may be highly contagious, as well as for other epidemics associated with respiratory transmission and a high demand for the hospitalisation of patients.

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Conflicts of interest statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Credit Author Statement

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