

# Pediatric orthopedics recommendations for infection prevention and management during the COVID-19 epidemic

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## Abstract

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) outbreak known as Coronavirus Disease 2019 (COVID-19) first appeared and expanded quickly around the globe. As of February 29, 2020, there have been 79 389 COVID-19 cases recorded, and the outbreak is responsible for 2838 fatalities. The community as a whole is susceptible to the illness, and individual incubation times after infection vary. These two COVID-19 characteristics present major diagnostic and therapeutic difficulties for pediatric orthopedic patients. Our hospital has mobilized all branches and departments to engage in joint actions for scientific prevention and control, precise countermeasure, and comprehensive anti-epidemic efforts as a designated center for managing pediatric cases of SARS-CoV-2 in Shanghai. Combined with our experience, we have consulted the relevant national regulations and the latest research advances and have formulated the prevention and control measures of SARS-CoV-2 infection, including outpatient, emergency, inpatient and surgical cares,

for clinical practices of pediatric orthopedics according to the physicochemical properties of SARS-CoV-2. It might be useful for managing SARS-CoV-2 infection in other pediatric specialties and other hospitals as practical references and suggestions.

## Introduction

Pneumonia was brought on by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)<sup>1 2</sup>. The 2019 Coronavirus Disease (COVID-19) started to devastate and spread across the globe. Despite being treated as a category A infectious disease, the SARS-CoV-2 infection has been formally classified as a category B infectious disease. The only hospital in Shanghai authorized to receive minors infected with SARS-CoV-2 is our facility. Numerous suspected and confirmed child cases have been admitted to the infectious diseases section.<sup>3 4</sup> During the pandemic, millions of people went back to work, particularly after the Spring Festival. There will inevitably be pediatric orthopedic routine, emergency, and surgical procedures. Human-to-human transmission of SARS-CoV-2 primarily occurs through physical contact and aerosolized droplets.<sup>5 6</sup> There are currently no known and effective antiviral therapies for COVID-19. Therefore, limiting contagious sources should be the top priority. Clearly, safeguarding medical personnel is essential to controlling and preventing epidemics. Our department created these recommendations after consulting pertinent national regulations, the most recent research findings, and advice from the advisory group. These recommendations were also meant to serve as a guide and suggestions for other pediatric specialties and/or other hospitals.

Given the high demand of patients for medical treatment and the need to protect medical staff from infectious diseases, a recommendation working group "Recommendation Formulating Team for Pediatric Orthopedic Infection controls during the Epidemic's Period of COVID-19" (including all authors) was formed to focus on relevant issues for protection of medical staff in pediatric surgery, pediatric orthopedics, infectious diseases department, anesthesiology department, and nursing department to hospital administrators.

Creating and improving the first level catalog, which includes

the clinical features of COVID-19, the applied population, the applicable people, the general principles, and the physicochemical characteristics of SARS-CoV-2. Procedures for prevention and control in juvenile orthopedics' outpatient clinics, ERs, hospitals, and operating rooms. Patients who are "typical," "risky," and "suspected" are protected.

### **SARS-CoV-2's physicochemical characteristics and COVID-19's clinical characteristics**

The seventh coronavirus to be discovered to infect humans is SARS-CoV-2. It belongs to the same coronavirus category as the ones that triggered severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS). (SARS). The primary coronavirus antigen and a typable marker is spike glycoprotein (S), which is found on the surface of the virus. For antigen identification, the virus' nuclear protein can be used. Studies on SARS-CoV and MERS-CoV have provided the majority of our knowledge regarding the physical and molecular characteristics of SARS-CoV-2. The virus is susceptible to ultraviolet light and heat, which can be used to inactivate it when heated for 30 minutes at 56°C along with lipid solvents like 75% ethanol, peroxyacetic acid, chlorine-containing disinfectants, and chloroform, but not chlorhexidine.

The transmission characteristics of COVID-19 are as follows.

**Infection sources.** The main sources of the infection are patients infected by COVID-19 with or without clinical symptoms. The incubation period is between 1 and 14 days, with a median incubation period of 3 days and a maximum of 24 days.<sup>10</sup>

**Transmission route.** The novel virus is spread through respiratory droplets when patients cough, talk loudly or sneeze. Close contact is also a source of transmission. Aerosol and fecal-oral transmission of digestive tract are also possible, while it needs to be further clarified.

**Susceptible population.** The age range of the reported infected population was 36 hours old to 96 years old, with no significant gender difference. The elderly and people with basic diseases are more likely to become severe cases. Children may have mild clinical symptoms after infection.<sup>11</sup> Nevertheless, medical personnel still need to pay more attention, closely monitor, and strive for early identification and timely treatment.

Severe cases are more likely to occur in the elderly and those with basic illnesses. After an infection, children may experience minor clinical symptoms.<sup>11</sup> Medical professionals still need to be more attentive, vigilant, and work toward early detection

and prompt therapy.

The National Health Commission of China's "Diagnosis and Treatment Program of 2019 New Coronavirus Pneumonia (trial sixth version)" described as follows on February 18, 2020.

### **suspect situations**

epidemiological background. (1) Travel or residence history in Wuhan, other regions with recent local COVID-19 transmission, or the neighborhood where a verified patient resides. (2) Close interaction with a patient who has COVID-19 with laboratory confirmation (positive for nucleic acid test). (3) Direct contact with residents of Wuhan, the surrounding region, or nearby local towns who have a respiratory illness

(4) Kids who have direct contact with COVID-19-infected cases or are connected to a cluster outbreak.

**Clinical symptomatology.** (1) Respiratory complaints or a fever. (2) Viral pneumonia imaging characteristics. Chest images of pneumonia cases in the early stages reveal numerous tiny patchy shadows and interstitial changes that are particularly noticeable in the periphery of the lungs. In severe instances, pulmonary consolidation, infiltrating shadows, bilateral multiple ground-glass opacity, and sporadic pleural effusion can also occur. (3) Low or normal white blood cell counts, or early-onset decreased lymphocytes. If a patient meets any one of the epidemiological background criteria and any two of the clinical manifestations criteria, they should be suspected of having COVID-19 infection. If the three clinical manifestations are present but there is no clear background of epidemiology,

### **Confirmed cases**

suspected instances that fit any of the subsequent descriptions. Reverse transcription polymerase chain reaction results for COVID-19 nucleic acid from respiratory system or blood samples were positive. (RT-PCR).

Blood or respiratory system samples can be genetically sequenced, and the results are very similar to the COVID-19.

On the premise of this, our hospital also released pediatric clinical practice recommendations.<sup>4</sup> Clinical manifestations and epidemiological history improved the screening of infants who may be at risk.

Even though the infection in children has been verified, there are a variety of clinical manifestations. Fever, cough, fatigue, myalgia, nasal congestion, runny nose, sneezing, pharyngeal

pain, headache, dizziness, nausea, vomiting, abdominal pain, and diarrhea are more prevalent among children with confirmed cases who had clinical data gathered.<sup>9</sup> This indicates that not all patients with coronavirus infection present with respiratory symptoms like cough, fever, and chest discomfort at the time of diagnosis. A small number of patients will have muscle pain, abdominal pain and diarrhea as the first main complaint; pediatric orthopedic surgeons and pediatric surgeons should pay attention to these conditions during the outbreak, pay attention to screening for COVID-19 and take measures to prevent the spread of SARS-CoV-2 infection in the hospital.

In reaction to SARS-CoV-2 infection, control and surgical handling flow of juvenile orthopedics at outpatient and emergency clinics According to the characteristics of SARS-CoV-2 infection, national and hospital requirements for prevention and control,<sup>4</sup> 9 combined with clinical practice in pediatric orthopedics, we specially formulated the outpatient, emergency, inpatient and surgical procedures for prevention and control of SARS-CoV-2 infection in pediatric orthopedics.

Patients who require additional testing should wear medical surgical masks and be accompanied by hospital staff. Auxiliary agencies that are pertinent should be alerted in advance so they can take preventative action and arrive back at the orthopedic clinic on time after the examination.

Following treatment, surfaces in the office are disinfected for 10 minutes with a solution containing 1000 mg/L of chlorine. After that, for 40 minutes, the air is sterilized using ultraviolet light. The orthopedic surgeon will base their choice on the findings of the physical and radiological examination using mathematical principles.

(1) If the patient's condition is minor, allow them to depart the hospital after receiving orthopedic clinic treatment.

(2) Work should be done in the debridement section on closed fractures that require immobilization with a plaster.

The orthopedist needs to be protected with at least level 1 protection (+1), which includes donning latex gloves, medical overalls, and surgical masks.

(3) The patient shouldn't be put in an arbitrary observation room if they need to see how their illness is changing. Before transferring to the orthopedic transition unit, "clinic fever" doctors should rule out the SARS-CoV-2 infection. For children who are alone, try to provide single rooms to minimize interaction

with other residents. Please consult "Diagnosis, treatment, and prevention of 2019 novel coronavirus infection in children: experts' consensus statement" after being hospitalized.<sup>12</sup>

(4) Request the doctor to rule out the chance of a suspected infection if the patient needs to be admitted to the hospital for surgery. Follow the "suspected child" protection process if the infection is suspected or proven. (see below). Such patients will be admitted to the orthopedic transition ward with distinct treatment management if COVID-19 infection is excluded.

(5) The following debridement and suture techniques should be used if the patient needs to endure debridement and suture operations without being hospitalized: Orthopedists and other employees should be protected at least to level 1 (+4) in a separate debridement room with medical overalls, caps, protective masks, face masks, and gloves made of bilateral latex. If tetanus vaccination is required, human immunoglobulin (non-skin test variety) should be chosen and administered by the injector who shares the same level of protection as the orthopedist in the debridement room. trash that needs to be dusted is treated with two layers of yellow trash bags in an airtight bucket. The bag is securely sealed after the trash has been sprayed with a disinfectant that contains 5000 mg/L of chlorine. The debridement area needs to be cleaned up after debridement.

safeguarding "suspected patients" (including confirmed patients)

The patient should first be sent to the "fever clinic" for SARS-CoV-2 infection testing if they are thought to be a suspected case. The patient should be isolated right away and reported to the hospital if the suspected case is verified. Additionally, two nucleic acid assays are run to check for SARS-CoV-2 infection.

In accordance with the requirements for prevention and control, the following orthopedic surgeons will bring their own tools and wear protective gear inside the infectious disease isolation building. For closed injuries, level 2 protection is typically offered, while level 3 protection is offered for high-risk procedures.

After the experts' debate, it is evident that the patient will be transported in a special transport vehicle through a special channel to the negative pressure operating room if an emergency or limited surgery is required. The isolation of suspected or proven children during the perioperative phase, as well as the subsequent protection, should receive special

attention. (1) Cut back on surgery patients. (2) The process must avoid peak hours and traffic. (3) Keep the operating area free from cross-infection. For instance, the operating room should use as much disposable equipment as feasible. The operating area should be cleared of any unnecessary equipment, and any items that cannot be removed should be covered with protective film. During the operation, surgeons, nurses, anesthesiologists and other relevant personnel need take at least level 3 protection: wearing double medical caps, medical protective masks (inner) and medical surgical masks (outer), protective face shield, medical protective clothing (inner) and medical isolation gowns (outer), double latex gloves and shoe covers. The medical isolation gowns (outer), surgical mask, cap, and exterior latex gloves are removed by the doctors in the operating room following the procedure. The doctors first perform hand disinfection with hydrogen peroxide, remove the inner latex gloves, and then perform hand disinfection once more with the hydrogen peroxide-containing disinfectant. According to the theory of eradicating epidemic sources, the operating area must be sterile. 4 A disinfectant containing 2000 mg/L chlorine is applied to the object surface of the operating room and left to work for at least 10 minutes. For an hour, hydrogen peroxide or hypochlorite is atomized into the air. Bags holding 5000 mg/L chlorine-containing medical waste and medical fabric waste must be sprayed with disinfectant before being handled as infectious medical waste and fabric. Postoperative medical waste is sterilized by being sprayed with a disinfectant solution containing 5000 mg/L chlorine and put in an airtight bucket with two layers of yellow garbage bags.

Medical staff may come into touch with bodily fluids due to occupational exposure during operation, such as surgical instrument damage to protective gloves or clothing. If this happens, halt the process right away, remove the safety measures in accordance with the aforementioned guidelines, and then handle the situation in accordance with the "Emergency Treatment Procedure After Sharp Instrument Injury" published by the Infection Quality Control Center. Fill out the "occupational exposure registration form" and report the incident to the hospital's pertinent departments. The pertinent agencies will carry out additional isolation or a precise diagnosis.

After the procedure, all medical staff who participated in it must be kept apart for monitoring. Lifting the isolation order is necessary if the suspicious patient is found to be free of SARS-CoV-2 infection. All medical staff engaged in the procedure are quarantined for 14 days if the patient is found to have

SARS-CoV-2. When exhibiting suspicious signs, he or she should promptly seek medical attention. To avoid contact with colleagues who were not engaged in contact with the patient during the time of isolation, medical staff used mobile phones to communicate with other staff members in the department.

### CONCLUSION

In order to serve as a resource for pediatric orthopedics and other associated departments, the clinical protective measures in pediatric orthopedics have been summarized in this section. We must promptly get in touch with qualified physicians for diagnosis and treatment for suspected cases. Additionally, it is necessary to optimize the protection process and steps in light of changes to national epidemic prevention and control measures. When treating juvenile orthopedic diseases and preventing and controlling epidemic situations conflict due to the evolving epidemic situation, it is important to take an overall approach and put more emphasis on preventing and controlling the epidemic situation.

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