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CASE REPORT

# SARS-CoV-2 and S. aureus coinfection in patients admitted to a pediatric ICU of a federal hospital in Rio de Janeiro: report of two clinical cases

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## Abstract

The pandemic caused by the SARS-CoV-2 virus in 2020 has plagued the world from mild to fatal. In our pediatric intensive care unit, we received two patients with severe acute respiratory syndrome (SARS) and methicillin-sensitive *Staphylococcus aureus* (MSSA) co-infection. The purpose of this article is to discuss the association of the SARS-CoV-2 virus with methicillin-sensitive *S. aureus*. These patients progressed to SARS, accompanied by deep venous thrombosis (DVT) and dependence on intensive care. They were tested for SARS-CoV-2 by viral PCR and blood culture of peripheral blood for *S. aureus* (MSSA), required invasive mechanical ventilation, use of vasoactive amines, broad-spectrum antibiotic therapy and therapeutic anticoagulation. Coronavirus is an RNA virus responsible for respiratory and gastrointestinal conditions, and can be transmitted by droplets, via the fecal route, fomites and contaminated surfaces. *S. aureus* is a bacterium responsible for pyogenic infections of the skin and soft tissues, and may evolve with hematogenous dissemination. The incidence of deep venous thrombosis is higher in critically ill patients, immobile and/or restricted in bed, even when using prophylactic anticoagulants. We conclude that staphylococcal infection contributed to the worsening of these patients, since in the pediatric population COVID-19 evolves in a mild way in most clinical conditions. These infectious agents are related to severe respiratory symptoms with systemic inflammatory response syndrome (SIRS), sepsis, SARS, shock and organ dysfunctions.

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## INTRODUCTION

In 2020, the country was affected by the COVID-19pandemic, a disease caused by the SARS-CoV-2 virus. Most pediatric patients have milder disease, but are not exempt from greater severity[1]. In our pediatric ICU, we had two seriously ill patients, presenting co-infection between SARS-CoV-2 and methicillin-sensitive Staphylococcus aureus (MSSA).

## CASE REPORTS

**Case 1:** Male patient, 12 years old, previously healthy, transferred from another hospital unit with suspected staphylococci. Previous report of trauma to the right lower limb during physical activity, with significant edema and restricted walking, diagnosed with deep venous thrombosis (DVT), confirmed by image examination (ultrasound), in the right iliac and femoral vein, required therapy with full anticoagulation, evolved with pneumonia associated with moderate bilateral pleural effusion, undergoing chest drainage. During hospitalization, the presence of SARS-CoV-2 was confirmed by viral PCR and S. aureus in two peripheral blood cultures. He had severe acute respiratory syndrome (SARS), evolved with refractory septic shock, requiring invasive mechanical ventilation and was subsequently placed in a prone position, vasoactive amines, renal replacement therapy, in addition to broad-spectrum antibiotic therapy. After five days of hospitalization, he died.

**Case 2:** Female patient, 12 years old, previously healthy, presented with cough, hemoptysis, anosmia and ageusia. Transferred from another hospital with a diagnosis of septic arthritis of the left hip with edema and paresis of the lower limbs, DVT and pneumonia with moderate pleural effusion on the right, with indication of chest drainage and hip arthrocentesis. During hospitalization, the presence of SARS-CoV-2 was confirmed by viral PCR and MSSA in synovial fluid culture and peripheral blood culture. Like the previous patient, he presented RASG with the need for invasive mechanical ventilation, evolved with septic shock refractory to the use of vasoactive amines. In this case, there was no need for hemodialysis and the outcome was favorable. The patient was discharged from the hospital after 30 days of hospitalization.

## DISCUSSION

Co-infection between SARS-CoV-2 and other viral pathogens, such as Influenza and Parainfluenza, has already been reported in several studies in the pediatric population; however, there is little data in the literature that describes its association with other infectious agents.[2]

Coronavirus is an RNA virus of the coronaviridae family, highly pathogenic and responsible, mainly, for respiratory and gastrointestinal syndromes. It has a high rate of contagion and can be transmitted by droplets, via fecal-oral route or through fomites and contaminated surfaces.[3]

According to Ludvigsson[4], JF (2020) in a systemic review of the literature, in the period from January 1st to March 18th, 2020, pediatric patients were responsible for about 1% to 5% of coronavirus cases and of these, 55% belonged to the age group between 10 and 15 years of age. Although most cases of COVID-19 described in children are asymptomatic or mild, a small portion requires hospitalization and of these, a minority requires intensive care.

*S. aureus* is a gram positive, aerobic bacterium that colonizes human skin. It is the main cause of pyogenic infections of skin and soft tissues in pediatric patients and can cause serious complications in any organ due to hematogenous dissemination. The development of staphylococcal infection depends on the host's resistance and the bacterial virulence.[5,6] The main sites of infection are bones, joints, lungs, skin and soft tissues.[7]

According to Vanderkooi et al.[8] the incidence of S. aureus bacteremia in pediatrics is 4 to 20 per 100,000 cases, varying according to the region studied. Between the years 2000 and 2010 there was an increase in cases due to the emergence of metacillin-resistant S. aureus (MRSA). Among hospitalized children, infection by S. aureus varies from 1.5 to 3.5 per 1,000 hospitalizations, with an estimated mortality rate of 4% to 9%.

The prevalence of DVT in pediatric patients is about 80 to 114 times lower than in adults, that is, it ranges from 0.07 to 0.14 per 10,000 patients[9], while in adults it reaches rates of 5.6 to 16 per 10,000 patients. Its incidence is higher in severely ill, immobile and/or bedridden individuals, even when using prophylactic anticoagulation. The formation of clots can be justified by the Virchow triad: endothelial injury by direct cell invasion, blood stasis due to immobility and a state of hypercoagulability, the latter being largely correlated to COVID-19.[10]

Literature reports demonstrate that most cases of COVID-19 are mild, so we could justify the severity of the disease only by staphylococcal infection. Even so, the co-infection between SARS-CoV-2 and S. aureus certainly contributed to the worsening of the inflammatory state and consequently the severity of the patients.

## CONCLUSION

The objective with this case report is to highlight that the patients were of the same age group and had no comorbidities; therefore, they did not belong to the risk groups related to the coronavirus, but they did present co-infection between SARS-CoV-2 and S. Aureus and evolved from severe form with variable outcome.

The two microorganisms, in isolation, are related to severe respiratory symptoms and progression to systemic inflammatory response syndrome (SIRS), sepsis, SARS, shock and organ dysfunctions. S. Aureus has long been present among the diagnostic hypotheses in pediatric patients, while

the coronavirus will probably become endemic in our country, thus becoming just as important.

These patients admitted to the pediatric intensive care service received anticoagulation at a therapeutic dose, since they had a previous clinical picture compatible with DVT. Recent observational studies correlate the state of hypercoagulability with the severe form of COVID-19, where disseminated intravascular coagulation (DIC) appears to be present in most fatal cases.

The variety of signs and symptoms and the lack of sufficient scientific information hinder the diagnosis and clinical management of COVID-19, since there are no protocols. In the context of patients admitted to pediatric intensive care units, we should be suspicious of co-infection with SARS-CoV-2 whenever they present with respiratory symptoms or even multisystemic involvement, and especially when SARS is characterized, even if there is another suspicious or even confirmed diagnosis.

In short, we can say that further studies are still needed to clarify the real role of SARS-CoV-2 coinfection with the most diverse pathogens in pediatrics and the consequences of this association on the evolution and severity of those infected.

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