CURRENT CONCEPTS REVIEW

Bone in the Time of Corona: Suggestions for Managing Pediatric Orthopaedics Conditions in a Resource-limited Environment during the COVID-19 Pandemic

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Abstract

The outbreak of a novel coronavirus, referred to as coronavirus disease-19 (COVID-19), with its sentinel case in Wuhan, China, in December 2019, has spread rapidly around the globe. On March 11, 2020, the World Health Organization (WHO) declared COVID-19 a worldwide pandemic, which led to most countries implementing social distancing protocols. Most non-essential medical practices have been halted to direct resources to the facilities caring for patients with COVID infection. The pediatric orthopaedic practice is in a unique position, with the treatment of many conditions being treated by pediatric orthopedists being non-emergent, but time-sensitive. We hereby review the current literature and guidelines surrounding the practice change around the world and give recommendations regarding the practice of pediatric orthopaedics during the COVID pandemic.

Level of evidence: V

Keywords: Clubfoot, COVID-19, Fractures, Pediatric orthopaedics, Pediatrics, SARS-CoV2

Introduction

The Coronavirus Disease 2019 (COVID-19) emerged in late December 2019 in Wuhan, China, and then quickly turned into a global pandemic (1, 2). As of April 4, 2020, a total of 1,096,460 confirmed COVID-19 cases have been reported around the world, of which 59,123 patients have died of the disease (3). Current therapeutic strategies include symptomatic and supportive treatment (4, 5), and efforts are focused on preventing the spread of the disease, until science 'catches up' with therapeutic options (6).

Orthopaedics in general, and pediatric orthopaedics in particular, are at the intersection of essential and non-essential medical services. We focus on the most common conditions that care providers in the field of pediatric orthopaedics treat, with an emphasis on the inevitable changes during the COVID pandemic.

Risk mitigation

While the health-care providers (HCP) have taken the oath to benefit the patients and the community, as individuals, self-preservation is the first responsibility of each and every health-care provider. The major route of transmission is through direct routes, such as respiratory droplets produced through coughing or sneezing (7). Accordingly, recommendations to slow the spread of infection have been made, which include universal masking (8, 9). With the current shortage in N95 masks (or masks with similar protection levels) globally, conventional surgical masks are acceptable alternatives. Any in-person clinical interaction should include proper PPE, including a face mask, gloves, and proper hand hygiene. Handshaking is strictly prohibited, and only essential physical examinations should be performed, and with utmost diligence.

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Pediatric orthopaedics involves not only the patient and parents, but also the grandparents, and in some societies, extended relatives. With the current situation and the highest risk of mortality in the elderly, the presence of any relatives except the parents is prohibited. Face masks for the family is recommended. Homemade cloth face masks are also acceptable in resource-limited regions (10).

Any surgical procedure carries a high risk of infection. Full PPE, preferably with N95 masks, is essential. Refer to the national/regional guidelines for surgery in infected patients.

Telemedicine

The potential for the use of telemedicine in the time of disasters and public health emergencies is evident (11). An effective telemedicine program cannot be implemented overnight, and the role of non-standardized, unorganized telemedicine visits in regions without an established telemedicine program is unknown. Initial visits for non-emergent conditions should be postponed until in-person visits can be performed, whereas post-operative visits and routine follow-up of patients that may not need a physical examination are perfect indications for telemedicine in pediatric orthopaedics. Patients should also be informed of the limitations of this communication method, and consent should be obtained (12).

Essential/Emergency procedures

Treatment of musculoskeletal infections should not be delayed or otherwise altered. Septic arthritis, acute osteomyelitis, and soft tissue infections are of this category. However, if possible, post-operative care and antibiotics should be administered at home to preserve the much-needed hospital beds. Surgical-site infections may be an exception, and the patients should remain hospitalized if there is a concern or a definite plane for re-operation.

Tumor surgery

Benign tumors are amenable to non-emergent care, and treatment should be delayed until the pandemic subsides. In the case of a benign skeletal tumor with an increased risk of pathologic fracture, high-risk activities should be avoided. A discussion with the family, preferably over a telemedicine visit, is crucial to prevent unplanned and unnecessary surgical procedures.

However, the treatment of malignant tumors cannot be delayed. Biopsy of highly-suspicious lesions should be performed as before. The initiation of chemotherapy for malignant tumors, however, is a double-edged sword. Delaying treatment inevitably leads to disease progression, whereas initiating chemotherapy induces an immunocompromised state, which renders the patient more prone to COVID infection. There are currently no guidelines on how to face the dilemma, but with no end in sight for the COVID pandemic, initiating proper treatment is recommended. Alterations to the treatment protocol may be done based on experience and institutional guidelines. Some institutions are skipping the neoadjuvant chemotherapy and proceed directly to surgery and perform the adjuvant chemotherapy afterward (Data not published, personal communication). More than ever, this vulnerable population should be treated in specialized centers with multidisciplinary care.

Spine

Surgical correction of spine deformities are elective, high-risk procedures, and should be postponed. However, bracing of patients with scoliosis should be continued, and the family should be informed of the risks of not adhering to the recommended bracing protocols. Compliance counseling has been shown to encourage brace wear and improve outcomes (13), and telemedicine might be especially useful to emphasize the importance of bracing to the patients and families. There is no data on how brace wearing behavior changes during social distancing and school closure. With the widespread use of electronic brace wear monitors in many institutions, future studies will decide what the effect of tele-counseling and home-schooling is on brace wear compliance.

Fractures

With child-care centers and schools closed, the pattern of traumatic injuries will inevitably change in children. Theoretically, the incidence of road traffic accidents will decrease, but the same cannot be said about common fractures in children. Distal radius, supracondylar humerus, forearm, and tibial fractures would still happen and will need treatment. With the available evidence, delaying the treatment of fractures is not recommended. There has been some debate about changing practice patterns to treat more fractures non-operatively. We strongly disagree with this argument. Any change in practice pattern would lead to more complications, and the need for hospitalization, in-person visits, and unnecessary surgeries would increase. Moreover, with elective surgeries being canceled, almost all fractures in stable patients can be operated and discharged on the same day. We, therefore, recommend adhering to the same principles of treatment as before for all fractures. Surgical education should be kept at a minimum, and the senior surgeon should be performing the surgeries with the minimum number of personnel required.

The only exception is a patient with an active COVID infection. In a series from china, 4/10 patients with fractures and active COVID infection died (14). Although the mortality rate is very low in children, and there are no reports of fractures in children with COVID infection, we currently recommend treating most fractures non-operatively in this group until their general condition stabilizes.

During the past few weeks, we have had several patients requiring surgical removal of a buried or migrated pin (unpublished data). The parents, fearing the pandemic, did not attend the follow-up visit to remove the percutaneous pins in the clinic. An unnecessary surgical intervention could have been prevented if the importance of timely pin removal had been emphasized.

Clubfoot

There are no official guidelines on the treatment of clubfeet in the social distancing era. It is true that a

few weeks out of a cast might not be detrimental to the foot. Nonetheless, the COVID pandemic might continue for months. A clubfoot out of a cast for months would certainly be more difficult to correct. Therefore, we do not recommend delaying, or even worse, stopping Ponseti casting for clubfeet, unless recommended by the regional governing bodies. However, casts could be worn for longer periods of time and changed every two weeks instead of one week. Also, plaster and soft cast material are preferred to fiberglass, which will only add a cast removal time to the clinic's workload. Tenotomies are minor procedures and may be performed if the protocol of the institution allows, and is performed in the clinic.

Developmental dysplasia of the hip

Unlike the previous conditions, the international hip dysplasia institute has issued its suggestions for managing DDH during the pandemic (15), and has recommended the following:

- For infants up to 6 weeks of age: start Pavlik harness with a positive clinical examination. Ultrasounds may be done later. Pavlik initiation by the family using the video resources online is also acceptable. The follow-ups may be conducted by telemedicine, and less frequent follow-up ultrasounds are recommended.
- For children 6 weeks to 6 months of age: Treatment of clinically diagnosed DDH in this age group should be done similar to the <6 weeks group. In this group, imaging may be delayed until resources are available. A few weeks of delay in treating this age group is unlikely to change the outcomes.

For children >6 months of age: In some cases, Pavlik harness may be initiated in this age group as well. However, closed reduction and casting, as well as any open procedures, should be postponed until resources are available.

Deformity correction / lengthening

Patients who already have an external fixator in place for deformity correction and/or lengthening should be followed-up closely. Bone consolidation will prohibit any further corrections if the adjustments are delayed for more than 5-7 days. Telemedicine is the perfect communication tool to follow-up patients with external fixators. Pin care should be emphasized to minimize the risk of infections and unnecessary surgical procedures. Pin sites, limb alignment, and the general condition of the external fixator are easily determined remotely. Instructions for adjusting the device could be double-checked by asking the patients to do them while on a video call. Radiographs may be taken less often if the patient tolerates daily adjustments easily. Patients in the maintenance phase could be monitored less often, and delaying the removal of the external fixator is recommended.

Summary

COVID-19 infection is the first pandemic of the 21st century. The initial response was delayed, which led to an extensive spread of the infection. Social distancing, closure of schools, minimizing non-essential travel, and relocating resources to medical facilities are being done to control the spread of the infection until a treatment or vaccine is available. With an unknown end to the pandemic and social distancing practices, the pediatric orthopedists should conform to a new norm. Our recommendations for treating the most common conditions faced by the pediatric orthopaedic surgeons during the COVID pandemic are summarized in [Table 1].

Table 1. Recommendation for managing the most common conditions in pediatric orthopedics during the COVID pandemic. MSK: musculoskeletal. SSI: surgical-site infection. DDH: developmental dysplasia of the hip. IHDI: International hip dysplasia institute.

Condition	Recommendations
Essential procedures	Infections of the MSK system, including septic arthritis, osteomyelitis, and SSI should be treated as usual. Traumatic dislocations requiring surgery are rare in children, but are essential procedures as well.
Tumors	Benign: Delay surgery. Counsel on activity restrictions if high-risk for fracture. Malignant: Surgeries should not be delayed more than a few days. Consider delaying chemotherapy to after surgery.
Spine	Elective surgeries should be postponed. Brace counseling recommended and may be done during telemedicine visits.
Fractures	Treat as usual. Day surgery is recommended for all fracture surgeries, preferably performed by the senior surgeon. Use plaster or soft casts for ease of removal. Follow-up visits may be done by telemedicine. Fractures in infected patients: Delay the surgery, if at all possible. Results of surgical interventions in patients with active infections have been poor so far. Emphasize pin removal visit to prevent buried or migrated pins.
DDH	Refer to IHDI suggestions [16]. Pavlik may be initiated and followed over telemedicine visits. Ultrasound could be performed less often.
Deformity correction / lengthening	Closely follow patients with an external fixator. Do not stop daily adjustments. Might be the perfect indication for telemedicine visits, as there is no need for a formal physical examination. Keep the external fixator in patients in the maintenance phase.

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