Challenges and response in the medical management of the orthopaedic department during the coronavirus disease 2019 pandemic: strategies in Wuhan, China

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Abstract

Purpose Currently, COVID-19 has rapidly spread around the globe, there are already many nosocomial infections in medical staff. The purpose of this study is to provide some medical management experience from the orthopaedics department of Tongji Hospital in Wuhan, China, to provide reference for orthopaedists.

Methods This study is a summary of the orthopaedic medical management of Tongji Hospital. It systematically summarized the Chinese experience including orthopaedic outpatient and emergency department management, and orthopaedic surgery and preventive management during the pandemic.

Results We described some challenges in the orthopaedic department during the epidemic and formulated a set of medical management procedures to find an balance between effective treatment and infection prevention.

Conclusion These experiences and strategies could help orthopedists to work safely and effectively, and prevent nosocomial infections during the global pandemic of COVID-19.

Keywords COVID-19 · Medical management · Pandemic · Preventive management

The coronavirus disease 2019 (COVID-19) cluster broke out in Wuhan in December of 2019. On January 20, 2020, the Chinese National Health Commission included COVID-19 into the national statutory report of category B infectious diseases. Meanwhile, this disease was prevented and controlled

in accordance with the preventive and control measures of category A infectious diseases, namely, the Law of the People's Republic of China on Prevention and Treatment of Infectious Diseases. The patients and virus carriers from the epidemic sites and areas were isolated and provided mandatory treatment [1]. Currently, COVID-19 has rapidly spread around the globe [2, 3], and this disease was soon declared a “pandemic” by the World Health Organization (WHO) on March 11, 2020. All countries were advised to take actions in order to change the course of this pandemic [4].

Although Wuhan experienced severe medical system overload in the initial phase, implementation of the “early detection, early diagnosis, early treatment, and early quarantine” policy and effective expansion of medical resources have ultimately led to successful containment of the pandemic, and the restoration of all city operations within three months.

The ability to perform routine clinical work remains a huge challenge for the medical personnel during this pandemic. Therefore, an effective work strategy must be established especially since the clinical and epidemiological characteristics of COVID-19 are still not fully understood. As one of China's renowned medical centers, Tongji Hospital of Huazhong University of Science and Technology has dedicated more

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than 2000 beds for the admission and treatment of COVID-19 patients in the peak period while continuing to provide necessary diagnostic and treatment services in the orthopaedic department. Our approaches and experiences may serve as a helpful reference for other regions.

Challenges in the orthopedic department

Due to the severe shortage of medical resources during the pandemic, many orthopaedic surgeons in Wuhan had joined the frontlines in the battle against COVID-19 after temporary training. The impact of the epidemic on orthopaedic medicine was unprecedented. All elective surgery in the orthopaedic department from the end of January to mid-March were cancelled as a result of the epidemic outbreak and the lack of medical staff. Although beds in the orthopaedic department were not requisitioned for the COVID-19 patients, we still had to redistribute our limited medical resources for the management of patients in the emergency department, the few patients requiring semi-elective surgery, orthopaedic rehabilitation, as well as the current inpatients, while at the same time finding a balance between effective treatment and infection prevention.

The patient population for orthopaedic diseases is relatively diverse. Degenerative diseases are common among elderly patients. This group of patients is often accompanied by comorbidities and is relatively immunocompromised, hence their conditions have a higher chance of turning critical after contracting COVID-19 [5–7]. On the other hand, sport injury patients are often younger, and trauma patients are of various ages. Some young COVID-19 patients may also have critical conditions and experience “cytokine storms” that can eventually lead to adult respiratory distress syndrome (ARDS) and multiple organ failure [8–10].

Despite the continuous decline in the number of confirmed and suspected cases, we should not let our guard down especially when asymptomatic patients and COVID-19 patients who were tested positive for novel coronavirus nucleic acid during recovery have been reported [11–14]. There is currently no consensus on whether these individuals are contagious, when they are at the peak of transmission, and what measures should be taken to screen them. Therefore, we must stay highly alert of any potential sources of infection. The complexity of COVID-19 has placed high demands on our clinical work, especially for management in the outpatient clinic and emergency department. As the orthopaedic general outpatient service reopened and the number of patients gradually recovered in late March, careful screening of each visitor (including accompanying family members) is extremely vital.

Orthopaedic patients sometimes need to move around in the hospital to complete the admission, examination, consultation, and transfer processes. Therefore, we needed to standardize these processes in order to prevent nosocomial

infections. Furthermore, we also needed to determine whether it is necessary to set up different teams based on the nature of the clinical work, divide areas by exposure risk levels, and adopt different work procedures in order to maximize the operational benefit of the existing medical resources and ensure the safety of all medical personnel.

The quality of care of patients during the pandemic was also a major area of our focus, including whether patients in the hospital have been satisfactorily taken care of and whether patients who cannot come to the hospital have received adequate remote guidance. In addition, our medical staff not only provided their expertise and skills in the fight against COVID-19, but also demonstrated tenacious faith and team spirit in overcoming this pandemic, and most importantly took care of their physical and mental health as well as their family members. It needs to be emphasized that we should also actively guide the growth of young physicians during this process.

General rules for orthopaedic consultation during the pandemic

Diagnosis and treatment should be provided to orthopaedic patients as much as possible under the condition of preventing the spread of COVID-19. Standard management procedures should be strictly followed along with the collaborative support of a multidisciplinary team (MDT). Except for critical or life-threatening cases, patients in stable condition from the emergency department should be switched to semi-elective or elective treatment/surgery as much as possible and a full COVID-19 screening should be completed within this time frame. Outpatient treatments in our hospital such as simpler endoscopic surgery, biopsy, nerve block, and external fixation should be encouraged in order to save resources, reduce the time patients spent in the hospital, and lower the risk of nosocomial infection. Temporary conservative treatment can be given to certain patients undergoing elective surgery, rehabilitation, or in non-urgent situations after their evaluations, and remote treatment and guidance can be provided through the Internet to maximize the interval between non-urgent return visits.

Orthopaedic outpatient clinic and emergency department during the pandemic

Diagnostic and treatment characteristics of the orthopaedic outpatient clinic and emergency department

Patients who visited the outpatient and emergency department during the pandemic demonstrated “more acute and severe” characteristics than usual, including but not limited to (1)

patients with acute pain, (2) patients requiring emergency surgery, (3) patients requiring semi-elective surgery, (4) patients with post-orthopaedic surgery complications, (5) patients returning for visits during rehabilitation, (6) special patient populations (such as elderly, pregnant, and paediatric patients with orthopaedic injuries), and (7) anxious patients.

Personnel and site management

This is applicable to the patients, their families, and medical staff. Patients should be required to wear masks and maintain good hand hygiene at consultation, and the number of individuals accompanying the patient should be controlled. According to the recommendation of the department of hospital infection control, medical staff must wear personal protective equipment (PPE), including a cap, medical protective mask, goggles, regular protective clothing, and gloves in the pre-examination triage, outpatient clinic, and emergency room during the pandemic. It was reported that wearing a N95 mask, disinfecting, and washing hands were effective in lowering the risk of COVID-19 infection in medical personnel [15]. For patients who could not be screened and needed emergency treatment, medical staffs were required to implement aforementioned standard protective measures and wear medical protective clothing and face shield.

Triage, pre-examination, and specialist consultation were set up in all Wuhan hospitals that were not designated for the COVID-19 patients to ensure multilevel screening. Patients who were not screened and needed emergency treatment were managed in isolated consultation, treatment, or observation rooms. The hospital reception had isolated waiting areas to allow for safe social distancing between patients. In addition, the hospital sites needed to have enhanced ventilation and increased hand hygiene facilities.

The recommended workflow of admission is shown in Fig. 1. The maximum number of consultations should be set according to the outpatient clinic and medical staffing levels, and patients should be seen in the order of their appointment. An emergency green channel should be set up for patients who required urgent treatment. Conditions that threaten life and physical function include but were not limited to important blood vessel and nerve injuries that can lead to shock, limb necrosis, limb severance, and extensive tissue loss. We recommended a complete blood routine, chest CT, viral nucleic acid, and/or antibody test as the routine exams to be performed in pre-examination triage. The items of screening are shown in Table 1. The screening results required the consultation of MDT experts. For specialist consultation (outpatient clinic and emergency orthopaedics), the physician must first determine the conditions of the patient's orthopaedic disease before proceeding to further treatment judgment.

Suspected cases identified in the outpatient clinic should be isolated immediately, and their consultation should be

arranged by designated personnel in the hospital. Caregivers of inpatients must also undergo COVID-19 screening. If necessary, the outpatient management system should register the information of patients for epidemiological follow-up. It is worth noting that having a buffer ward in the inpatient department is an effective method for screening potentially infected patients and preventing cross-infections during the pandemic. The main function of this ward is to allow for observation and screening of all admitted inpatients before determining their management. Compared with SARS, the peak load of 2019 novel coronavirus appears earlier in the symptomatic body, and the exposed person may even appear infectious before symptoms appear [16–18]. Due to these characteristics and Wuhan's current epidemic situation, we recommend that inpatients be screened again after four to five days of observation in the buffer ward.

Orthopaedic surgery during the pandemic

We must consider both the pandemic environment and patient benefit when conducting orthopaedic surgery during the pandemic, and be more cautious than usual about the indications for surgery. Short, minimally invasive, and low contamination surgical approaches should be used for emergency conditions including but not limited to (1) severe haemorrhagic injury, open injury, tension-induced injury, and unstable hip fracture; (2) severe spinal cord injury and unstable spinal fracture that hinder COVID-19 treatment and care, and require decompression and internal fixation; (3) joint dislocation; and (4) severe infectious lesions. Simple approaches should be used to stabilize the conditions of orthopaedic disease in severe and critical COVID-19 patients until their lung functions are improved.

The indications for semi-elective surgery include but should not be limited to (1) secondary damages caused by unstable spinal fracture that cannot be restabilized by conservative methods, (2) fast-growing bone and joint tumors that are not suitable for radio chemotherapy and the patient has an expected survival time of more than one year, (3) progressive neurological disorder caused by spinal disease, (4) unstable pelvic fracture with stable haemodynamics and the absence of important tissue injury, (5) unsatisfactory reduction of limb and joint fractures, and (6) severe pain caused by fluid accumulation in the joint or soft tissue or empyema, severe nerve root pain, and pain caused by bone tumour.

We conducted several elective surgeries in late March based on the medical resources we had. However, careful consideration must be given to elderly patients and patients with underlying diseases even if they have the indications for orthopaedic surgery.

Patient transfer and surgery rooms can be managed based on previous experiences [19, 20]. Pre-operative MDT consultation is necessary for the development of surgery and intra-operative

Fig. 1 Admission in the orthopaedic outpatient clinic and emergency department during the COVID-19 pandemic. COVID-19, coronavirus

disease 2019; CT, computed tomography; ET, epidemiological history; ICU, intensive care unit

life support protocols. When performing surgery on suspected or confirmed COVID-19 patients, all personnel involved must wear a complete set of PPE (including face shield), and the number of surgical staff and surgical items must be strictly controlled. Staff should be cautious about the aerosols generated by electrocautery during the operation, reduce flushing of the instrument, avoid splashing and residual body fluid of the patient, and avoid accidental injury caused by sharps. If an X-ray is required during the operation, the surgical staff should wear lead aprons in advance. Moreover, accurate handling of intra-operative contaminants is also very important [21].

Confirmed COVID-19 patients should be transferred to a negative pressure ward after surgery and managed by the orthopaedics department and MDT. Suspected patients should also be placed in single isolation rooms after surgery and transferred to the general ward only if they meet the criteria for quarantine release. The flow of people within the general

ward must be controlled, and their body temperature must be strictly monitored. Medical staff should provide good post-operative care to the patients, reduce nebulization-related operations, and pay attention to post-operative fever. Our medical staff in the orthopaedic department used the online consultation system to provide patients with post-operative rehabilitation and management suggestions, and completed satisfactory follow-ups.

Preventive management

There is currently over three million COVID-19 cases worldwide, and the ability to cope with and handle these cases remains a challenge for the public health system of various countries. Although orthopaedics is a specialized area of medicine and our medical staff lack expertise in COVID-19

Table 1 COVID-19 screening form

No.		Name			Gender			Age	
Complications		No	☐	Yes	☐	Including			
Respiratory rate				Resting oxygen saturation					
Symptoms	Fever	No	☐	Yes	☐	Body temperature			Days
	Dry cough	Fatigue	Nasal congestion	Runny nose	Sore throat	Muscle pain	Diarrhea	Shortness of breath	
	☐	☐	☐	☐	☐	☐	☐	☐	
	Other								
Medication history before diagnosis			Anti-inflammatory and analgesics/antipyretics			Antivirals/antibiotics		Other	
	Used/Not used								
	Name								
	Duration								
	Efficacy								
Epidemiological history	Travel/residence history within 14 days								
	Contact with confirmed/suspected cases within 14 days								
Serological test	WBC count								
	Lymphocyte count								
	Other serology								
Chest CT									
Nucleic acid and/or antibody test									
Other pathology tests									
MDT consultation result		Confirmed	☐	Suspected	☐	Screen again after observation		☐	

COVID-19, coronavirus disease 2019; CT, computed tomography; WBC, white blood cell

treatment and isolation, we still needed to implement adequate preventive measures, report suspected cases, and reinforce self-protection in the face of this pandemic. Measures we have taken included (1) having a good grasp of knowledge on nosocomial infection, such as disinfection and isolation procedures, key routes of occupational exposure, and post-exposure handling measures; (2) performing medical operations, especially invasive procedures, in a standardized manner to avoid injury from sharp instruments; (3) being familiar with the screening, diagnosis, and transfer procedures for suspected cases; (4) being proficient in wearing PPE, and being able to correctly identify and use effective protective tools; and (5) learning psychological counseling to relieve psychological pressure and ensuring adequate rest.

We established an emergency surgical team in the orthopaedic department to handle emergency surgery and surgery for suspected COVID-19 patients, as well as a buffer ward team and outpatient clinic team. These teams have high exposure risk and must be isolated from other medical staff. Team members must undergo health observation after the completion of their work and may only return to their original positions if they pass the health observation. Fortunately, our department has a special team that offers life and mental support to the family members of our medical staff, organizes social fundraising, and regularly provides logistic support for our clinical staff.

Standardized procedures can definitely benefit medical personnel and patients during an epidemic outbreak. However, as routine medical procedures are being performed, we must analyze the conditions of each patient before deciding on each measure. Our scientific and prudent attitude has also given us strength to keep fighting until COVID-19 is defeated.

Compliance with ethical standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical review committee statement This study was approved by the Ethical Review Committee of Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, People's Republic of China.

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