

# Orthopaedic trauma care during the early COVID-19 pandemic in the Asia-Pacific region

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## Abstract

The Asia-Pacific region countries, with their large and socioeconomically diverse populations and infrastructures, were amongst the earliest to have to respond to the COVID-19 pandemic. Although the disease is not one of surgical trauma, its effects on orthopaedic injuries have been significant. Medical systems had to adapt to better focus on patients with a highly communicable disease, while continuing to provide essential services. Even though many countries saw a decrease in traumatic injuries during the initial periods, orthopaedic trauma services nevertheless had to adapt accordingly to system-wide organizational changes. While each country took their individual approaches to address the pandemic, there were also consistencies in how musculoskeletal injuries and conditions were handled during these early stages of the pandemic. This article reviews those early management approaches to musculoskeletal injury care during the COVID-19 pandemic in different countries throughout the Asia-Pacific region following the initial outbreak in China: Australia, South Korea, and Japan.

**Keywords:** Asia-Pacific, Australia, COVID-19, Japan, orthopaedic surgery, pandemic, South Korea, trauma

## 1. Introduction

In 2020, the novel coronavirus pandemic started in Asia, with its well-known and widely published effects on societies, including health services and economics. The implications on orthopaedic trauma services are well reported in the literature; high-energy trauma was significantly decreased in locations where lockdown rules were in place, recreational and interpersonal violence-related admissions had varied effects, and geriatric hip fracture presentations remained virtually unchanged. Reporting the effects of the pandemic on orthopaedic trauma services is crucial to better understand the organization of these services during this

pandemic. Many of the countries in Asia learned about the virus and successful ways of mitigating its spread from their neighbors.

While reporting pandemic-associated activity changes that can drive local and national responses is an essential responsibility, the urge to publish has sometimes curtailed the standard editorial processes, resulting in COVID-19-related publications of varying quality. In general, standard epidemiological principles should continue to be applied to the data collected on COVID-related infections. The most reliable studies will continue to be population-based with prospective data collected whenever possible during both pre- and postlockdown periods.<sup>[1]</sup> Some pandemic-related changes in prehospital destination protocols and self-presenting isolated injuries from a fearful general public to COVID-19 designated centers can alter the volumes of individual centers, but not necessarily on overall regional population-based scales.

This review summarizes some of the specifics of the orthopaedic trauma responses of Asia-Pacific member countries of the International Orthopaedic Trauma Association, specifically Australia, Japan, and South Korea.

## 2. Australia

Australia, as an island country, efficiently applied early restrictions to arrivals from certain geographical areas and soon locked down the entire country. By July 5, there were only 897 coronavirus cases reported across Australia. Notably, 781 of these cases were situated in Victoria, the most densely populated state of Australia, with 89% of them obtained locally. Data suggests this increase can be attributed to community transmission in the Greater Melbourne Area. Only a small percentage of those infected required intensive care, and only 1.2% of Australian cases resulted in fatality.<sup>[2]</sup> The number of cases, intensive care unit admissions, and mortalities were low-to-moderate compared with other countries.<sup>[3]</sup>

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the importance of maintaining trauma services without reallocation of essential trauma staff for general pandemic associated tasks. South Australian data showed no decrease in pediatric trauma,<sup>[4]</sup> but drops in adult trauma similar to that in other geographic regions.<sup>[5]</sup> Some preliminary results showed that major trauma mortality during the strictest lockdown and physical distancing period decreased compared with the age and injury severity matched controls.<sup>[6]</sup> While the concept has not been proven on larger datasets beyond single-center experiences, it is reasonable to speculate that a lower volume of patients with specialists focusing only on the public hospital and not on other clinical commitments could provide better care.

Most Australian states and territories did not experience a second wave.<sup>[7]</sup> The exception is Victoria, where the second wave was more pronounced than the first and their case numbers and mortalities were higher than the most populous state of New South Wales.<sup>[8]</sup> At the time of the writing of this manuscript (November 2020) there were no newly reported cases in Australia and the worst hit state of Victoria opened up from their second lockdown.

### **2.1. Organizational actions made to trauma services**

Orthopaedic trauma services followed the recommended standards of care, with extra precautions taken during the pandemic. The nationwide hold on elective surgery freed up orthopaedic surgeons to contribute to safe and sustainable rostering, hospital management, and junior physician allocation. In most of Australia, elective surgery resumed after the initial wave had subsided, and various strategies were put in place to manage the considerable backlog of planned orthopaedic surgical procedures. During the later phases of the pandemic, the Australian Orthopaedic Trauma Society coorganized and participated in some of the biggest ever virtual orthopaedic conferences in the Asia-Pacific region in collaboration with many International Orthopaedic Trauma Association nations (TRAUMACON; <http://traumaconmumbai.com/>) and over 50,000 online registrants.

### **2.2. Other important/unique experiences and lessons learned**

Overall, Australia had a highly cautious approach to the pandemic. Orthopaedic trauma care was not significantly affected in Australian hospitals, with the exception of those worldwide shifts toward virtual clinics and delays in later postinjury reconstructive surgery, such as nonunion and malunion management.

## **3. Japan**

In Japan, the first confirmed case of COVID-19 infection was recorded on January 16, 2020, occurring in a Chinese national who had recently visited Wuhan.<sup>[9]</sup> On February 3, 2020, many of the 3711 passengers and crew members of a cruise ship called “Diamond Princess” were found to be infected when it docked in the Port of Yokohama. Subsequently, the number of infected individuals amounted to 696 (19.2%), 7 of whom died.<sup>[10]</sup> As of March 2, the number of domestic infections was up to 239 and the death toll was 6, excluding those detected aboard the Diamond Princess. The number of cases in Japan started growing quickly, mainly in urban areas.

The Japanese Cluster Response Team of the Ministry of Health was established on March 9, with 3 specific aims: early detection

of and response to infection clusters; early patient diagnosis, enhancement of intensive care, and the securing of a medical service system for the severely ill; and behavior modification of citizens (including advice to refrain from holding large-scale events and temporary school closures). The medical experts reviewed the data from the Cluster Response Team’s work and further refined its definition of a high-risk environment as a place with the overlapping “3 Cs” (3 crowdedness): closed spaces with poor ventilation; crowded places with many people nearby; and close-contact settings such as close-range conversations.

On April 7, 2020, Prime Minister Abe proclaimed a 1-month state of emergency for Tokyo and the prefectures of Kanagawa, Saitama, Chiba, Osaka, Hyogo, and Fukuoka. On April 16, the declaration was extended to the rest of the country indefinitely. At the end of April, the number of domestic infections and the death toll had reached 13,852 and 389, respectively, showing exponential increases. However, the mortality rate has remained relatively low at 2.8%.<sup>[11]</sup> By age group, those aged 80 or older experienced the highest mortality rate of 12.3% (155/1263 infections), significantly higher than that of those in their 70s (5.8%; 77/1327 infections). The shortage of medical resources and the spread of infection among hospital personnel from nosocomial transmissions had become problematic, both domestically and internationally.<sup>[12]</sup> On May 25, Japan ended the state of emergency. By the beginning of July 2020, the number of domestic infections and the death toll had reached 19,461 and 977, respectively.

### **3.1. Organizational actions made to trauma services**

The organizational efforts across Japan were relatively consistent, with many of the changes made to hospitals guided by the local governments. Some of the hospitals from the busiest metropolitan areas faced the greatest challenges. As an example of the specific responses emblematic of the management of trauma patients during the COVID-19 pandemic, the experience at a major trauma center in Tokyo (Teikyo University) will be reviewed.

### **3.2. Actions of the Tokyo Metropolitan Government**

Initially in Tokyo, patients with COVID-19 infections were treated mainly at designated hospitals for infectious diseases. In mid-April, the national government issued a request (not an order) for people to refrain from going outside, and the Tokyo Metropolitan Government also followed this same request. The number of patients with COVID-19 continued to increase and the designated hospitals for infectious diseases could not handle the patient loads. The Metropolitan Government then requested cooperation from university hospitals and emergency centers to secure additional beds for COVID-19 patients.

### **3.3. Conditions at Teikyo University Hospital**

At Teikyo University Hospital, the medical treatment system was changed to a mainly internal medicine focus and a fever outpatient clinic was set up in the emergency room. A single entrance to the hospital was created and thermography was installed. The number of beds requested by the Metropolitan Government was increased in stages, with a maximum of 10 beds for severely ill patients, and 30 beds for minimally to moderately ill patients. Part of the intensive care unit, which provided medical care for critically ill patients, was dedicated to the

patients with COVID-19, thereby limiting the number of beds for other patients. There was a shortage of personal protective equipment (PPE) supplies at the hospital, particularly the N-95 masks.

### **3.4. Trauma patient management**

The admission procedure for trauma patients with a fever was multifaceted. Patients who were transported by ambulance were checked for a fever, travel history, and contact history. If COVID-19 exposure was suspected, the patients were directed to the fever outpatient clinic. Polymerase chain reaction (PCR) tests were performed on patients suspected of being infected with COVID-19. However, because of the time needed to obtain results, a chest computed tomography was taken for those patients who needed acute surgery. In severely traumatized patients without sufficient prior information, they were treated as if they were infected and chest computed tomography scans were performed at the initial presentation. When patients were transferred from other hospitals, a careful patient history was taken including whether they had experienced fevers and their travel and contact information. If the patient had a fever after admission, the surgery was delayed as late as possible until the return of the PCR test results. Currently, PCR tests are performed preoperatively on all patients undergoing surgery.

### **3.5. Procedures in operating room**

Although planned surgery was limited by 50%, urgent and emergent surgery for trauma patients was not. The number of doctors present for a surgical case was limited to the minimum number necessary, and the PPE use was strictly adhered to, including the use of goggles. At the time of intubation for and extubation from general anesthesia, all providers except the anesthesiologist and circulating nurse left the room and waited until the procedure was complete. One negative pressure room was prepared and used for surgery on patients with suspected COVID-19 infection.

### **3.6. Measures for the trauma team**

The order of patient transfers, transfer of patients requiring highly specialized surgery, provider staffing during periods of reduced work, reorganization of trauma teams, and organization of outpatient work was planned in advance through a command center system. In the event of a COVID-19 outbreak in patients or staff, mask wearing was mandatory to prevent high-risk contacts. To prevent the trauma team from being decimated, daily conferences were held with a minimum number of people for short periods of time and other information was shared using online platforms. Furthermore, personnel would not eat meals with other personnel and would take leaves if they had any cold-like symptoms. Major orthopaedic trauma was prioritized as follows: open fractures, pelvic fractures, spinal cord injury, closed acute fracture, malunion/nonunion.

Likely due to the national restrictions on movement and travel, the numbers of severe trauma cases decreased. Proximal femur fractures in the elderly were increased compared with the previous year at referral hospitals, possibly because they were not being accepted at neighboring hospitals. At the time of writing of this report (July 2020), there were no significant COVID-19 outbreaks among trauma providers or their patients.

### **3.7. Effect on clinical care delivery from trauma service**

A survey was conducted among the directors and international committee members of the Japanese Society for Fracture Repair from 17 Japanese facilities to determine how the COVID-19 pandemic affected trauma cases. Data from January to April of 2018, 2019, and 2020, revealed that 10 university and city hospitals handled fewer trauma cases in 2020, which is likely attributable to the restricted movement of people. There were only 2 city hospitals that had greater trauma case volumes in 2020, compared with the same periods of time in previous years. Although those 2 hospitals were located in relatively big cities, they did not have to deal with the same numbers of COVID-19 cases.

Regarding the triage of trauma cases, many surgical academic societies, including the Japan Surgical Society and the Japanese Orthopaedic Association, provided recommendations. Considering the global spread of COVID-19, these societies recommended that surgical treatment be limited to patients requiring emergency surgery for life-threatening conditions, trauma, paralysis, and malignancy, and that elective surgery for patients with nonfatal or nonurgent diseases be postponed.<sup>[13]</sup> Fortunately, there were not considerable numbers of patients with concomitant fractures and COVID-19 infections reported in Japan.

### **3.8. Other important/unique experiences and lessons learned**

Despite an early exposure, a dense and aging population, and few social distancing measures, Japan reported low early infection and death rates due to COVID-19. However, there is still not enough information to determine the cause of these remarkable results. Many different studies have been proposed to account for these findings, including the examination of ACE2 expression levels in the respiratory tract,<sup>[14]</sup> GWAS data on COVID-19 susceptibility, and the success of BCG vaccines to confer long-term innate immune resistance to the virus.<sup>[15]</sup> The 3-pronged approach by the Cluster Response Team of the Japanese Ministry of Health has thus far contained the spread of COVID-19 by quickly identifying clusters of infections, testing and quarantining the infected individuals. A word of caution regarding this successful approach is whether these processes will work for large-scale super-spreader events or when there are multiple simultaneous clusters that occur throughout the country. Perhaps one of the reasons for the low number of cases in Japan might relate to lack of super-spreader events to date.

With Japan seeing an increasing number of COVID-19 cases currently, surgical indications should be adequately assessed to ensure safe treatment and, if surgery is deemed necessary, all conceivable measures must be taken to lower risks of infection during the management and periprocedural control of the operating room.

## **4. South Korea**

The global COVID-19 pandemic has affected nearly every aspect of life in South Korea, and it continues to be an unprecedented health issue. Nearly 20 days after the outbreak started in China, South Korea confirmed its first case of coronavirus. By February 19, the number of cases had increased to 60. While it was not considered significant at that time, the number of infected patients suddenly increased exponentially beginning on February

22, with the cumulative number of COVID-19 patients reported accordingly: February 22—422; February 25—1111; February 28—2728; March 2—4272; March 6—6738; and March 16—8271. The level of alert was elevated from “orange” (cautious) to “red” (serious) on February 23. Unfortunately, Daegu became an epicenter of the COVID-19 national pandemic and gained notoriety. The steep increase of infection cases began to decline in mid-March.<sup>[16]</sup> The government implemented a strong social distancing policy and ordered an increase in the production of filter masks, which remained the simplest and most effective PPE. As masks were in short supply initially, the government took over the sales of masks so that they could be distributed evenly to the public.<sup>[17]</sup> At the time of completion of this current report (June 30), the cumulative number of patients afflicted by COVID-19 in Korea was 12,800. Among them, 11,537 had recovered, 981 were still in quarantine, and 282 died.<sup>[18]</sup>

Quieter city streets with less vehicular traffic, due to the implementation of strong social distancing, “shelter-in-place” orders, and “stay at home” policies, notably reduced the volumes of trauma cases. In Daegu, for example, the volume of orthopaedic trauma cases early in the pandemic decreased during the months of March (22 in March 2020 vs 85 in March 2019), April (27 in April 2020 vs 84 in April 2019), and May (55 in May 2020 vs 87 in May 2019). Nevertheless, as the main hospital in Daegu is a Level I trauma and tertiary referral center, there still were a reasonably large number of acute trauma patients to manage during this time period.<sup>[19]</sup>

#### **4.1. Organizational actions made to trauma services**

All patients who presented to the clinic with fractures requiring operative treatment underwent COVID-19 testing preoperatively prior to admission (usually a day before), temperature checks, and screening (i.e., questions about any respiratory symptoms, risk factors, and recent travel). Additional measures included the screening of all persons (health care providers, staff, patients, and their caregivers) entering the hospital or clinics with similar screening measures, including body temperature, and screening questions for any respiratory symptoms, risk factors, and recent travel within the previous 14 days.<sup>[20]</sup>

Patients presenting through the emergency room that required urgent procedures were managed at the earliest possible time, which was not significantly different from the routine, pre-COVID-19 workflow. These patients also underwent testing for COVID-19 and, if a negative result was obtained, the operative procedure was performed as usual. For patients requiring surgery prior to their COVID-19 test results becoming available, they were considered to be positive until the definitive test results were obtained. Results from PCR testing usually take 6 hours to return and are typically released twice a day, as tests are performed in batches at the hospital level.

Unlike a normal operating room where the direction of the airflow is directed from the operating room to the outside, one operating room furthest from the center of the operating room suite was converted into a negative pressure room with reversed air flow for surgery on confirmed or suspected COVID-19 cases. Patients were transferred directly to the operating room, forgoing the preoperative holding area. The doors to the operating room were kept closed during the procedure with the most minimal number of surgical staff possible to complete surgery. Everyone in the operating room wore full protective equipment, such as surgical hoods, goggles, face shields, N-95 masks, surgical gowns, and gloves. Surgical team members who were not directly

involved in the procedure (e.g., anesthesiologist, circulating nurse, etc.) remained as outside observers to reduce the risk of contamination.

Operations were performed using damage control principles for severely injured patients, minimizing manipulation and surgical duration. Only essential procedures were carried out, such as fasciotomy, arterial repair, hemorrhage control, and external fixation. After a procedure on a COVID-19 suspected patient, the operating room was left vacant for at least 30 minutes after cleaning with chlorine disinfectant. If a patient that initially received a damage control procedure and was subsequently confirmed to be COVID-19 positive, a secondary procedure was still carried out per the usual orthopaedic trauma standards of care. These protective protocols were employed to decrease nosocomial spread of COVID-19.

#### **4.2. Other important/unique experiences and lessons learned**

Testing has been readily available in South Korea, making it possible to identify COVID-19 patients earlier and deal with infections more expeditiously. With the initial introduction of unique systems, such as drive-through testing and public mask wearing, which were not adopted early in many countries, South Korea has been successful in curbing the COVID-19 spread without establishing entry bans on foreign countries.<sup>[21]</sup> Although the COVID-19 pandemic situation continues to be more favorable in South Korea compared with other countries, the pandemic continues through the time of writing this report. Local outbreaks and mass infections are still occurring in succession sporadically with no clear end in sight. Although orthopaedic trauma surgeons are not the front-line staff for COVID-19 management, they still play a role in the larger health care ecosystem, managing traumatic injuries associated with death and disability. Surgeons must take precautions to keep their provider teams and patients safe. Although Korea is cited throughout the international community as having model systems to deal with the COVID-19 outbreak, there is a continued need to implement prevention strategies.

#### **5. Conclusion**

This review highlights some of the specifics of the Asia-Pacific region, which is where the COVID-19 pandemic originated. Although this report, authored by surgeons from more affluent countries, does not represent the full spectrum of orthopaedic trauma care adopted throughout the region during the pandemic, it nonetheless documents the range of management policies and procedures in major countries throughout the region. While not a powerful population-based overview, this report reviewed the initial responses of South Korea, Japan, and Australia to the rapidly evolving global catastrophe, each having their own important learning points for the world.

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