



Lessons from what we learned in Korea: shield the medical facilities and health care providers



In-Ho Jeon, MD, PhD *

Department of Orthopedic Surgery, Asan Medical Center, College of Medicine, University of Ulsan, Seoul, Republic of Korea

In late February 2020, South Korea developed into the country with the second-highest COVID-19 cases after Mainland China. Nations around the world have faced a similar rise in infection, whereas their doctors and medical staff are being challenged with a high risk of exposure to the infection and a novel, grave mission as the medical profession.

Since then, South Korea carried out several actions to “flatten the curve.” The number of new cases reported in South Korea distinctly decreased to less than 20 cases on April 19, 2020, from the peak of 909 new cases reported on February 29, 2020. There are signs that South Korea’s outbreak is starting to ebb—accumulated total infection: 10,674; death: 236; cured: 8114; under treatment 2324; and total screening tests performed: 563,035, until April 20, 2020.

Our experience in South Korea could pave the way for a successful protocol to defend against the COVID-19 pandemic. We would like to share the background of effectively implemented measures for the pandemic crisis in South Korea so that we may consider fighting against any future outbreak.

Lessons from the MERS outbreak in 2016: Why is it important to protect the health care system and providers?

A lesson has been learned from the traumatic experience with the 2015 outbreak of Middle East respiratory syndrome (MERS), where South Korea suffered the largest outbreak of MERS outside of the Middle East. A total of 186 cases were confirmed, 38 people died, and more than 16,000 were quarantined. That painful memory from the outbreak of MERS in South Korea started with 1 patient who had spread the MERS coronavirus to 28 patients including health care providers at the hospitals he had visited.¹ Hospitals innocently became one of the major routes of transmission for the MERS outbreak at that time. For example, 85 of the 186 confirmed MERS cases in South Korea occurred among health care workers at 1 major medical center, which had more than 2500 beds and was completely locked down for several weeks. Tight shielding of the medical facilities and health care professionals should be the first step to fight against the infectious disease. Losing the health care system is like

going to a gun fight without bullets. “If the health care system falls and becomes incapacitated, we all must fall as well.”

In a recent analysis of the Organization for Economic Cooperation and Development member states with over 3000 confirmed virus cases, those with greater hospital bed capacity tended to have a higher recovery rate. Therefore, providing protective equipment to health care providers should be the first action in the fight against the virus.

The best effort to protect the health care workers was provided with high-standard quarantine protocols. The infection rate of COVID-19 among the health professionals was reported as low as 2.4% in South Korea (Korea Centers for Disease Control and Prevention [KCDC], April 2020).

Code of conduct

Control access of any suspicious patients

Building up the concrete screening protocol based on “epidemiologic relevance” is critical to protect and sustain the health care system and health care providers. The entrance of the hospital building is the frontline for screening. Health care workers with protective equipment inspect all visitors by using a thermal observation device. It is mandatory for all visitors to use hand sanitizer and wear masks before entering the hospital.

All patients are asked to submit a survey with core questions to investigate the “epidemiologic relevance.” The core questions include possible contact with an infected or suspicious person, traveling history, and high-risk area visited by the patient in the last 2 weeks. If the initial screening protocol discovers suspicious patients, they must visit “the screening spot” outside the hospital building and take the real-time reverse transcription polymerase chain reaction (RT-PCR) screening test for COVID-19 (SARS-CoV-2). They are only allowed to enter after the screening test results turned out to be negative, which usually takes less than 6 hours. The detailed screening protocol for patient hospitalization, emergency unit evaluation, and medical testing is presented in [Figure 1](#).

Massive real-time RT-PCR screening test for COVID-19 (SARS-CoV-2)

From the lesson of MERS in 2015, the government of South Korea brought in “Emergency Use Authorization” as a fast-track

* Corresponding author: In-Ho Jeon, MD, PhD, Department of Orthopedic Surgery, Asan Medical Center, College of Medicine, University of Ulsan, 86 Asanbyeongwon-gil, Songpa-gu, Seoul 138-736, Republic of Korea.

E-mail addresses: jeonchoi@gmail.com; inhojeon@amc.seoul.kr (I.-H. Jeon).

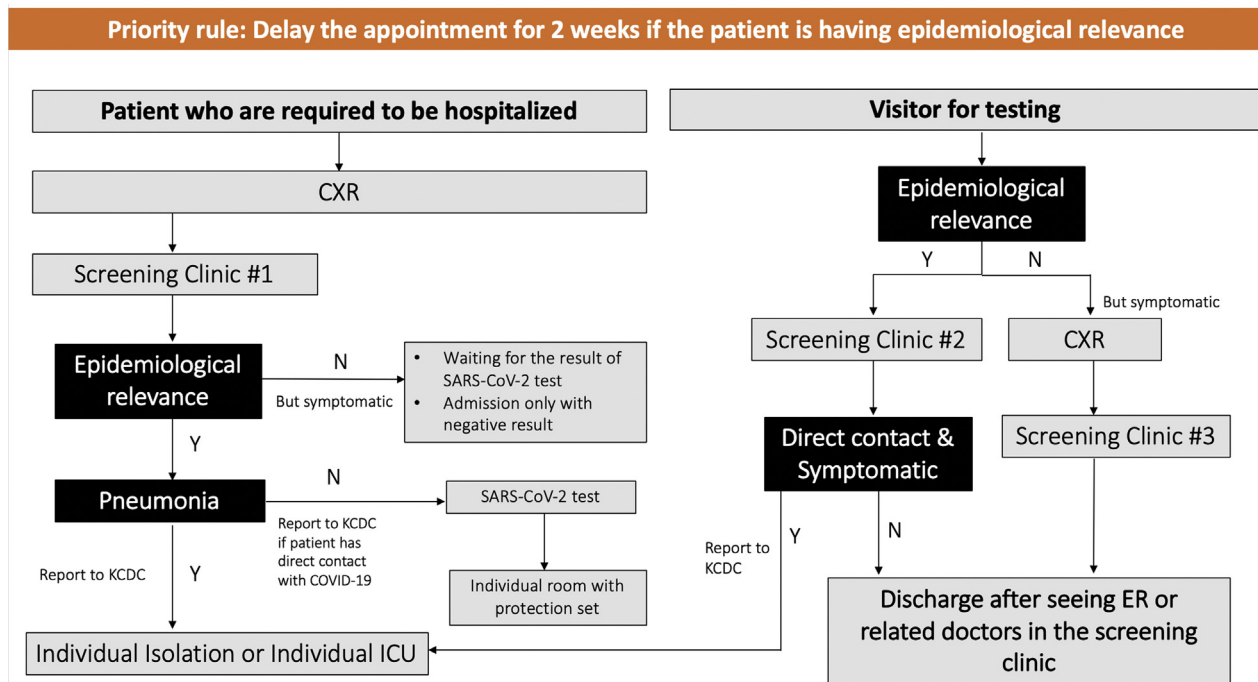


Figure 1 Screening protocol. CXR, chest x-ray; ER, emergency room; ICU, intensive care unit; KCDC, Korea Centers for Disease Control and Prevention.

process to approve the use of the clinical testing device under the special need in national health care emergency. With the process of Emergency Use Authorization, the diagnostic kit using the real-time RT-PCR was quickly approved and all facilities focus on producing the diagnostic kit under the government support. Drive-thru and walk-thru testing enabled us to do massive screening tests in a short period of time. A total of 10,000-15,000 people were being tested in a day. South Korea did a lot of testing early in the pandemic and followed it up by tracing the contacts of anyone who was infected; this action seems to be most successful in slowing the spread of the disease so far. Fewer deaths than the worst affected countries were reported. The number of tests per million population may be a useful statistic to predict lower fatality rates.

Smartphone-based tracing system

South Korea was effective in tracing people who may have been in contact with those who tested positive for COVID-19. On the basis of smartphone GPS data, authorities publicize the moving history of COVID-19-positive patients and all local governments post information on locations they have visited through the website.

Another good example is online consultation using a smartphone. More than 10,000 health care workers in the author's hospital must report their health status every day, which includes respiratory symptoms and temperature by using a mobile application. If their family at home had any symptoms, then they would have a consultation from the infection control committee in real time. Any discovered suspicious case will immediately be evacuated from the health care activity and quarantined until the screening test (SARS-CoV-2) turns out to be negative.

Instruction for COVID-19-positive patient in the hospital: experience in Asan Medical Center

A 9-year-old girl hospitalized for acute headache was confirmed positive in her second screening test, even though she was

completely symptom free and the first screening test of RT-PCR was negative. After an immediate report to KCDC, the patient was sent to the negative pressure isolation room in the intensive care unit and all health care providers who practically and potentially contacted the patient in the ward were isolated immediately.

KCDC decided "cohort isolation" for the whole ward with 43 health care providers and patients. RT-PCR for COVID-19 was tested immediately on the same day for 500 people, including health care providers, patients, and their family members. All results were reported as negative except for 1 case who was the mother of the next bed patient in the same room who tested positive after 3 weeks.

Surgical decision in the COVID-19 pandemic

In the COVID-19 pandemic, the surgical decision is challenging for both patients and surgeons (Table 1). In Asan Medical Center, we continue orthopedic practice based on the guidelines and maintain the clinic and operating room following the strict regulations and protocols.² Once the surgical decision is made, patients should meet the following criteria for elective surgery. (1) negative test result for SARS-CoV-2 (real-time RT-PCR), (2) no fever episode for the last 2 weeks ($<37.5^{\circ}\text{C}$), and (3) no history of travel to the epidemic area for the last 2 weeks. If the patient has any new respiratory symptoms and fever on operation day, the operating surgeon must report to the infection control committee in the hospital for final decision.

Orthopedic surgery for the patient with COVID-19

Elective orthopedic surgery is recommended to be delayed for patients with COVID-19; however, any fractures that can deteriorate lung function such as a hip fracture or spine fracture have to be operated as emergency cases. The core principle to proceed with surgery is (1) the operating room with negative room pressure, (2) enhanced personal protective equipment: level D with a powered air-purifying respirator, (3) the professional anesthesiological

Table 1
Surgical procedures continued to be performed during the COVID-19 pandemic

Emergency surgery	Shoulder elective surgery	Elbow elective surgery
<ul style="list-style-type: none"> • Open fractures (including impending pathological fractures) • Select closed fractures that, if left untreated for >30 d, may lead to loss of function or permanent disability • Irreducible dislocation of native or prosthetic joint • Penetrating wound into the bone, joint, and nervous system injury • Native and periprosthetic infection • Deep tissue infection 	<ul style="list-style-type: none"> • Locked labral tears • Unstable glenohumeral joint dislocation • Grade 4-5 acromioclavicular joint separations with severe pain or tenting of the skin • Acute rotator cuff injury • Pectoralis major complete rupture 	<ul style="list-style-type: none"> • Distal biceps tendon rupture • Unstable elbow subluxations or dislocations • Locked osteochondral defects of the elbow • Triceps tendon tear

support, (4) the route control from the isolated room to the operating room, (4) minimizing exposure of surgical equipment in the operating room, and (5) meticulous sterilization in every contacted place with the patient and patient-related materials.

Educational and research activity in the COVID-19 pandemic

Educational and research activity is also affected during the outbreak; thus, we control the damage by using a teleconference and web-based lectures. Every educational activity including journal review, staff lectures, and x-ray conferences was held in the first few weeks, but now it is replaced with a teleconference.

Clinical trial and a prospective clinical study for a planned visit were advised not to be conducted during this period. However, Biologic, Biomechanical, Animal, and Cadaver-related research was continued as planned with a limited number of researchers. All medical congresses were cancelled or replaced by online meetings if they were relevant to the pandemic situation.

Closing remarks

One major lesson the South Korean government learned from its MERS outbreak was the importance of early warning and accurate diagnoses. It highlights the importance of cutting the chain of infection in the country by supplying the hospitals and medical personnel with proper equipment, massive early testing for any

suspicious cases, and also encouraging people to wear face mask and implement strict social distancing.

The threshold for hospitalization is quite low in South Korea. Seoul has relatively more hospitals than other major cities elsewhere. The surplus of hospitals in South Korea worked very well with “public-private friendship” to cope with the COVID-19 pandemic. The mobile-based tracking and sharing the route for the infected person operates in an effective way to reduce person-to-person transmission. South Korea has been successful in controlling the spread of the virus with a low death rate compared with other countries so far; thus our experience could suggest a possible guideline for elsewhere in the world.

Disclaimer

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