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Case Report

Overseas Air Medical Repatriation of National Soccer Players Infected With Coronavirus Disease 2019 and Contacted Staff From Austria to South Korea

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ABSTRACT

Korea rarely has a system to transport patients from abroad. However, single-patient transfers are steadily being performed, and there was an experience of transferring a large number of personnel regardless of whether they were confirmed or not due to coronavirus disease 2019. Recently, a national soccer game was held abroad, and a total of 8 players and staff were infected. A total of 15 people were transported through a charter fully equipped with quarantine equipment by a medical response team with experience in air transport.

Coronavirus disease 2019 (COVID-19) is known to transmit via airborne particles in humans.1,2 The biggest hurdle when transporting patients suspected of having such infectious diseases is the risk of further infection. In particular, when transporting patients from abroad, there are many things to consider, such as long-distance travel time, meals, and toilet use. In countries where overseas transport systems are well established, such as the United States, there are dedicated airplanes, transport personnel, and companies involved in these transports.

Korea’s overseas medical transport system is extremely underdeveloped, although there have been reports of the transport of noninfectious patients abroad.3 However, during a pandemic like COVID-19, countries have to evacuate a large number of their citizens from dangerous areas, and, as such, Korea has transported a large number of people from Japan, Iran, Spain, Italy, and Wuhan, China.4 Unfortunately, such transports were performed without confirming if the patients were actively infected, and military personnel were often used for the safety of the flight crew and the rescue personnel. Additionally, these transports had insufficient protection for passengers, and the possibility of in-flight disease transmission was very high. Currently, COVID-19 vaccines are still being developed, and, unfortunately, the number of infections is increasing. We are hopeful that this situation will improve in the future, particularly with the development of a COVID-19 vaccine.5 In the event that multiple confirmed cases occur in foreign countries requiring the transport of those patients home, more advanced methods are needed to ensure the safety of crewmembers as well as patient stability, instead of just evacuating patients in large numbers, as has occurred in the past. In the United States, a report published by Cornelius et al6 contained relatively systematic content regarding transporting infectious patients, but there are limited experiences and reports regarding which are appropriate for each country’s situation and the number of infected people. Therefore, we report our experience with transporting COVID-19–infected athletes and staff in contact with them in Austria where the national game was held.

Materials and Methods

Target Group

COVID-19 infection of players and staff occurred after the Korean men’s soccer team arrived in Vienna, Austria, for the national friendly match. After the game, the noninfected athletes returned to Korea, and a total of 16 infected players and some staff members remained on-site. The transfer request was received through the Korea Football Association and the Ministry of Culture, Sports and Tourism.

Flight Information

The charter was prepared by an Asiana Airlines plane, which departed at 12 PM local time on November 25, 2020, for Incheon International Airport, to arrive at 6 AM on the 26th. The plane was a Boeing
777 model (H8254) with 24 business class and 271 economy class seats and a total of 12 crewmembers, 4 captains and 8 cabin crewmembers.

**Air Medical Evacuation Team**

**Members**
Two emergency medicine specialists were onboard. They worked at an emergency medical center for 10 to 20 years and had experience with a variety of patients; they also had more than 3 months of experience working with and treating confirmed COVID-19 patients at medical institutions, were experienced in long-distance overseas transport for 2 years; and were members of sports-related research groups and academic societies.

**Preparations**
Two experts prepared the equipment for specialized resuscitation. These included airway management instruments, monitors that measure oxygen saturation and heart rate, and an oxygen generator (AirSep FreeStyle 3, Buffalo, NY, USA) (Hamilton T-1, Bonaduz, Switzerland) certified by the Federal Aviation Administration. In addition, emergency medications for resuscitation, antipyretics, and respiratory-related medications were prepared.

**Analysis**
Means and standard deviations were used for all variables and were expressed as percentages.

This study was approved by the institutional review board and supported by Soonchunhyang University. There was no conflict of interest.

**Results**

**Flight and In-Flight Management Results**

**Seating Arrangements**
Asiana Airlines’ prewritten flight arrangement (Fig. 1A) was divided into 3 zones: zone A was a clear zone for the crew and captain, zone B was a nonconfirmed zone for the staff and response teams, and zone C was a confirmed zone for the athletes and staff. After takeoff, the response team received a final report on the status of the Asiana Airlines’ route, flight attendants, and passengers; zones A, B, and C were in the same group. The response team’s section was changed to zone A, and zones B and C were revised to include the window seats and 1 row back (Fig. 1B). Movement between each zone was limited to a minimum, and if movement was required, the safety protective clothing of level D was worn and removed. One medical staff member and 1 flight attendant were in a group and decided to take turns every 2 hours. On duty, they would wait in buffer zone 2 and check each area every 30 minutes.

**Buffer Zones**
The buffer zone screens were made of swinging plastic disposable doors with magnets attached to both sides and were meticulously installed on both sides of each zone (Fig. 2A). Buffer zones were designated in 3 places, with zone 1 designated as a space for crew and response teams to change in and out of protective suits. After the central portion was blocked off, the left side was designated for crewmembers, and the right side was designated as a toilet for the response team. Zone 2 was designated for noninfectious patients on the left and right sides of zone B, with designated toilets on each side and double-installed screens to distinguish zones B and C. Zone 3 had...
2 toilets designated for confirmed passengers on the left side and 2 at the entrance, and the central portion was separated by a screen. The right side was designated as a space for 2 crewmembers for standby or takeoff in protective clothing and a dedicated toilet (Fig. 2B). After departure, the response team covered the area based on the relevant research report because the upper area of the screen was empty.

Entrance

Vehicles with a staircase-type structure were placed at the entrances through an outdoor moor (Fig. 3A). The entrance at the front of the plane (number 1) was designated as a dedicated passageway for flight attendants and response teams to board first. The central passage (number 2) was designated as a dedicated passageway for passengers in zone B, and the rear passage (number 3) was designated as a passageway for passengers in zone C. At each location, ambulances and transport vehicles were ready and waiting (Fig. 3B).

Crew Training

The response team conducted training for all crewmembers, except the captains, on their way to Austria. A detailed description of the passengers’ responses and precautions for each zone was provided. Because the flight attendants had no experience in wearing protective clothing, the response team conducted a demonstration for training on protective wear (Fig. 4). Optimal personal protective equipment (PPE) was used, including disposable lab coat with booties and a hood, a double layer of gloves (either taped in place or secured with a thumbhole technique to prevent a sleeve gap), and an N95 mask with a face shield. The commercial set of level D type PPE (MG2000, 3M company, MN, USA) was mainly used. All passengers’ movements were monitored, and directory signs, such as those indicating toilets, were manufactured and installed to prevent confusion among passengers.

Boarding the Airplane

Loading was performed simultaneously at the central and rear entrances using the same method. Specifically, individuals came up the stairs one by one. After this, each passenger doffed their protective gear; sprayed disinfectant; donned a new mask, facial shields, and gloves; sprayed disinfectant on their belongings; and was then guided to their seat. The logic behind doffing the original protective clothing was that it was highly likely to be contaminated between takeoff and landing due to bathroom use during the long flight, and the National Emergency Management Agency and the response team decided to proceed after a meeting just before departure. After boarding, the basic safety rules during flight were notified by the crew through the broadcast, and the response team additionally broadcasted the following major precautions.

1. Keep passengers from moving as much as possible, allowing them to use only their designated restrooms, with no waiting in line
2. Seat passengers by windows, keeping their head by the window, even when lying in the seat
3. Structured in-flight meals
4. Make sure to wear masks, facial shields, and gloves while moving about the cabin
5. Educate passengers on the use of the call button for flight attendants in case of emergency
6. Every 30 minutes, the crew and medical staff worked together to inspect each area; patients with symptoms were equipped with equipment on their fingers to measure oxygen saturation and heart rate

Figure 3. Entrance and exit. A, The staircase-type entrance vehicle was moved to the outdoor apron. B, Local ambulances and transport vehicles were placed at each designated entrance.

Figure 4. The response team trained the crew on how to put on and take off PPE.
Dining and Disposal of Passengers’ Food
The passengers’ meals were packed in boxes and loaded in advance. To minimize the time during which masks were not worn, there were dedicated mealtimes. A dedicated plastic bag was provided for waste collection, and it was required that meal trash be disposed of in these plastic bags, which were collected in batches after an announcement by the response team after landing.

Preparation for Landing
An hour before landing, after the meal announcement, the response team delivered a notice regarding preparations for getting off the plane. After landing, the plane stopped at the mooring station, and the seat belt sign was turned off under the captain’s direction. The response team handed out level D protective suits (MG2000) prepared in advance, demonstrated how to wear them, and checked passengers for appropriate use. Afterward, they verified the names of passengers assigned to ambulances that had arrived in advance, and those passengers boarded the ambulances to be taken to the National Medical Center. Noninfectious passengers and the response team got off the plane and were then taken from the mooring station to a special quarantine station by bus; after inspection, they were moved to the Paju Training Center or their homes.

Target Group Results
Enrolled Group Characteristics
A total of 16 people were targeted before leaving Korea. Of these, 9 (5 soccer players) were infected, and 7 were reported as noninfected. At the predeparture inspection in Vienna, 1 player was judged negative and returned to the foreign team, and a total of 15 were transferred. Eight of 15 were positive; 4 were soccer players, and 4 were staff. The remaining 7 were noninfected and were all staff. They returned home 18 days after their departure. After being confirmed in Austria, they were in self-isolation at the hotel. Of these, 4 had respiratory symptoms, but only 2 had symptoms when boarding because the treatment was performed by the remaining team doctor and the local hospital physician; the others were asymptomatic.

Passengers’ Symptoms
Of 8 COVID-19 patients, 1 (13%) had respiratory symptoms, such as coughing, and 1 (13%) had symptoms of nasal congestion, whereas the other 6 confirmed COVID-19 patients had no symptoms. Although there were mild respiratory and nasal symptoms in some positive passengers, they were very stable in vital signs during the flight.

In-Flight Requirement Execution Results
Of the passengers, 3 non–COVID-19 passengers failed to maintain their window seats. There were no other unusual findings.

Dispersion Results After Arrival
Eight infected people were immediately transported to the National Medical Center and quarantined by conducting polymerase chain reaction (PCR; a screening test was conducted to test the RdRp and E gene with real-time PCR by Seegene, Seoul, South Korea) tests at a special place. Seven non-COVID passengers were tested via PCR at the airport, 5 of whom were quarantined at the Paju National Football Center and 2 were self-isolated at home for 2 weeks. Two response team members also received negative results from PCR tests yet were subject to quarantine due to being classified as active monitoring targets being required to report symptoms for 2 weeks. Flight attendants and emergency medical professionals also performed COVID-19 tests, and all tested negative. Except for the previous confirmed cases, there were no additional positive cases.

Results of Boarding Time
It took an average of 7 minutes 36 seconds per person to take a seat after removing his or her protective clothing (Fig. 5), which was provided locally in Austria. It took an average of 2 minutes 52 seconds per person to take off the double-layer protective suit. It took an average of 4 minutes 34 seconds for each person to sit down after spraying the disinfectant. The most time undressing was spent removing the protective suit from the lower body due to the extra layer, and additional time was spent arranging the luggage after moving to the seat.

Discussion
Any infection carries the risk of propagation, and methods of minimizing transmission include reducing contact as much as possible, maintaining social distancing, and not allowing many people in 1 place. Transporting patients abroad, in particular, is a very difficult task because it must be performed in accordance with these principles. In the late 1970s, the US Army Medical Response Institute of Infectious Diseases created the air medical isolation team, which was designed to safely care for and evacuate contagious patients in high-level containment conditions. It was primarily intended as a bioterrorism response and for the extraction of scientists or health care workers with infections in foreign countries. Early missions focused on hemorrhagic fevers, and although the team was deployed only 4 times, it was also used in an advisory capacity for respiratory syndromes, including severe acute respiratory syndrome and multidrug-resistant tuberculosis. Korea also transferred patients from Japan, Iran, Spain, Italy, and Wuhan, China, via chartered planes, which targeted ordinary Koreans whose diagnoses were not confirmed, and these long-distance transports were handled by the military-led collective transport system. In the United States, the US Department of Health and Human Services air medical evacuation teams of the National Disaster Medical System directly supported 39 flights, moving over 2,000 individuals, all of whom were either COVID-19 positive, persons under investigation, or individuals who were asymptomatic. During these transfers, many countries, airlines, and experts discussed how to create and maintain the environment on the plane.
The response team described in the present report performed by referring to the only study reported thus far. Plastic sheeting was used to create an area in which to segregate and treat patients who developed symptoms while airborne. We were able to block areas off more effectively using magnetic products. On long-distance flights, the front of the plane was designated as a space for flight attendants and response teams to rest, taking into account the flow of air in the plane. PPE was to be worn if the contact distance was less than 6 feet, and, at a minimum, a fitted N95 mask and gloves were recommended to be worn when the contact distance was at least 6 feet. Based on this information, flight attendants and response teams entering and leaving zones B and C were required to wear such PPE; otherwise, gloves and masks were required, and face shields were only required when moving about the cabin. For safe work practices, response teams, restrooms for crewmembers, passengers, and moving lines were all divided and marked. Additionally, an alcohol-based hand sanitizer was placed in various places for self-hand hygiene. To meet these recommendations, it is necessary to involve various human resources and agencies, and more reporting and references from various agencies are needed in the future.

In 2014, when Ebola spread, the US government and World Health Organization worked together to develop and use the connected Bio-Contention System, which allows intensive medical treatment on planes. The transfer of a number of COVID-19 patients and contacts in Korea should be performed with a combination of state, sports association, and private medical personnel. Before COVID-19 in 2019, the number of overseas travelers in Korea was very high, reaching nearly 40 million, and there were numerous accidents and transfers. Fortunately, in this case, the patients being transferred were not seriously ill, but it is also necessary to introduce such a critical patient transfer system in Korea in the future. It also calls for training professional personnel, guidelines for each disease, and the introduction of private jets.

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