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Brief report

In-flight transmission of COVID-19 on flights to Greece: An epidemiological analysis



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ABSTRACT

Background: The emergence in China in late 2019 and subsequent progression of a pandemic of a respiratory disease named coronavirus disease 2019 (COVID-19) was highly facilitated by international travel. We present 5 cases of probable in-flight transmission in Greece.

Methods: We studied international passengers arriving to or departing from Greece from February 26 through March 9, 2020. Contact tracing extended up to 4 days before the onset of symptoms and focused on close contacts. Close contacts were defined as persons sitting within a distance of <2 m for >15 min, including passengers seated two seats around the index case and all crew members and persons who had close contact with the index case.

Results: We investigated 18 international flights with 2224 passengers and 110 crew members. Main countries of departure included Northern Italy, Israel and the United Kingdom. In accordance with the national surveillance investigation, in these flights there were 21 index cases and 891 contact traced cases. Six index cases were symptomatic during the flight. Of the 891 contact traced cases, 4 passengers and 1 crew member developed laboratory-confirmed infection (3 with COVID-19 and 2 with asymptomatic infection); they travelled on the same flight with two COVID-19 cases.

Conclusions: Air travel has played a central role in the progression of the COVID-19 pandemic. However, there are scarce data about in-flight transmission. Our extensive investigation showed five cases of probable in-flight transmission. Efforts should be placed in order to ensure the prompt implementation of appropriate infection control measures on board.

1. Introduction

A novel coronavirus named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) emerged in China in late December 2019 and caused a respiratory disease, named coronavirus disease 2019 (COVID-19). Now the world is facing a COVID-19 pandemic declared by the World Health Organization (WHO) on March 11, 2020 [1].

International airline travel, transporting large volumes of people of different nationalities worldwide, represents an important vehicle for the transmission of emerging infectious diseases, including COVID-19, through either the transportation of already infected travellers or through in-flight transmission of the etiologic pathogen [2,3]. Factors that increase the risk of in-flight transmission of respiratory pathogens include the possibility of airborne spread, transmissibility during

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asymptomatic, mild or pre-symptomatic periods as well as long incubation period [3].

In Greece the first COVID-19 case was diagnosed in Thessaloniki on February 26 in a traveller returning from Italy and was followed by another 4 imported cases in Athens [4,5]. The aim of this report is to describe five cases with SARS-CoV-2 infection of probable in-flight transmission during a commercial flight carrying the first imported cases in Greece.

2. Methods

We recorded information on contact tracing performed from February 26 through March 9, 2020 on international flights to and from Greece. Criteria for in-flight contact tracing included travel of an index case within 1–4 days prior to symptom onset or while being symptomatic, based on a mean incubation period of five days (range: 2–14 days) of COVID-19 [6]. Contact tracing focused on close contacts (distance of <2 m for >15 min), including passengers seated two seats in all directions around the index case and all crew members and persons who had close contact with the index case (e.g. travel companions or persons providing care) [6,7]. Advice was provided to all close contacts for 14-day self-quarantine following their last exposure and self-monitoring for respiratory symptoms and/or fever and to contact the National Public Health Organization's hotline for further advice in case of symptoms onset. SARS-CoV-2 infection was diagnosed by real-time reverse transcriptase polymerase chain reaction (RT-PCR). In particular, nasopharyngeal or oropharyngeal dacron swabs were collected from suspected individuals. RNA was isolated from 250 µl of PBS rehydrated swabs in a final elution volume of 70 µl, using the automated Promega's® Maxwell Viral Total Nucleic Acid Purification Kit. SARS-CoV-2 RNA was detected employing Genesig's® COVID-19 CE-IVD real-time RT-PCR kit according to manufacturer's instructions and starting from 8 µl of eluted RNA. A COVID-19 case was defined at that time as a case with signs and symptoms compatible with COVID-19 in a patient with laboratory-confirmed SARS-CoV-2 infection, including fever or symptoms of acute respiratory infection of no other cause, and a recent travel history to a country with evidence of local transmission of SARS-CoV-2 or close contact with a laboratory-confirmed case [4].

Airlines were requested to provide valid contact details including telephone numbers and/or e-mail addresses and nationality of

passengers in order to facilitate contact tracing of passengers following their exposure risk assessment, if indicated. The completion of passenger locator cards was also recommended for airlines to facilitate subsequent contact tracing of passengers seated within two rows of an infected person according to current WHO guidelines for case management of airborne infection in-flight [8].

3. Results

Contact tracing was carried out in 18 international flights with passengers travelling to and from Greece during the study period (Table 1). Main countries of departure included Northern Italy, Israel and the United Kingdom. Detailed information was available for passengers in 16 flights and for crew members in 17 flights, respectively, while detailed epidemiological data about the 21 index cases were available in all 18 flights. In the 18 flights the number of index and contact cases was 21 and 891, respectively; of them, 85.7% and 44.3% of passenger contacts were Greek citizens, respectively. In terms of onset of symptoms, 6 index cases were symptomatic during the flight, 12 developed symptoms 1–3 days after their arrival, and two reported symptoms 5 and 7 days after the flight, respectively, whereas for one case no data was available. Out of all contact traced cases, 4 passengers seated within two seats to the index cases and one crew member were diagnosed with SARS-CoV-2 infection; they travelled on the same flight from Israel with two COVID-19 cases (index cases) who had symptoms during the flight (approximately 2 h duration). Telephone contact revealed that the two index cases belonged to a pilgrim group visiting Jerusalem. Three out of four contact traced passengers who were tested positive, were members of one family returning from Israel [4]; two of them developed symptoms 4 and 5 days after their trip, respectively and the third remained asymptomatic. The fourth contact case was also asymptomatic. The crew member developed symptoms 4 days after the flight. In all five cases (four contact traced passengers and one crew member) the test was performed 4–7 days after their trip. None of the contact cases who were diagnosed positive for COVID-19 required hospitalization. Further epidemiological investigation revealed that more than 90% of the members of the pilgrim group where tested positive [9].

Table 1

Contact tracing in passengers and crew in 18 aircrafts, 26/2/2020–9/3/2020.

| Flight (City of Departure) | Date 2020 | Passengers (No) | Crew (No) | Index case | | | | Contact traced cases | |
|----------------------------|-----------|-----------------|-----------|------------------------|-------------|--------|-----|----------------------|-----------|
| | | | | Onset of symptoms 2020 | Nationality | Gender | Age | Passengers (No) | Crew (No) |
| 1 (Milan) | 22/2 | 158 | 6 | 25/2 | GR | F | 50 | 19 | 6 |
| 2 (Bergamo) | 23/2 | 166 | 6 | 25/2 | GR | F | 39 | 16 | 6 |
| 3 (Bergamo) | 26/2 | 166 | 6 | 29/2 | GR | M | 65 | 9 | 6 |
| 4 (Prague) | 26/2 | 142 | 7 | 4/3 | GR | F | N/A | 29 | 7 |
| | | | | N/A | GR | M | 54 | | |
| 5 (Tel Aviv) | 27/2 | 164 | 6 | 29/2 | GR | M | 67 | 163 | 6 |
| | | | | 26/2 | GR | M | 43 | | |
| 6 (Athens) | 28/2 | 157 | 6 | 1/3 | GR | F | 28 | 157 | 5 |
| 7 (Barcelona) | 28/2 | 110 | 6 | 1/3 | GR | F | 28 | 110 | 5 |
| 8 (Athens) | 29/2 | 134 | 6 | 1/3 | GR | F | 28 | 134 | 5 |
| 9 (Tel Aviv) | 1/3 | 80 | 6 | 1/3 | GR | F | 28 | 80 | 5 |
| 10 (Athens) | 1/3 | N/A | 6 | 3/3 | ISR | M | 37 | 12 | 6 |
| 11 (USA) | 1/3 | N/A | N/A | 4/3 | US | M | 70 | 28 | N/A |
| 12 (London) | 3/3 | 131 | 6 | 6/3 | GR | M | 58 | 22 | 6 |
| 13 (Tel Aviv) | 3/3 | 137 | 6 | 5/3 | GR | F | 58 | 30 | 6 |
| 14 (London) | 4/3 | 146 | 7 | 9/3 | GR | M | 56 | 19 | 7 |
| 15 (Tel Aviv) | 6/3 | 114 | 7 | 3/3 | ISR | M | 37 | 9 | 7 |
| 16 (London) | 7/3 | 168 | 7 | 8/3 | GR | F | 57 | 8 | 7 |
| 17 (London) | 8/3 | 100 | 10 | 7/3 | GR | F | 54 | 14 | 10 |
| 18 (London) | 8/3 | 122 | 6 | 8/3 | GR | M | 53 | 10 | 6 |
| | | | | 9/3 | GR | M | 35 | 22 | |
| TOTAL | | 2224 | 110 | 20 | | | | 891 | 90 |

4. Discussion

Two recent studies from China and one from France showed evidence of in-flight transmission of SARS-CoV-2 [10–12]. Our extensive investigation revealed five SARS-CoV-2 infected cases of probable in-flight transmission and particularly in four passengers and one crew member on a flight from Israel to Athens. Acquisition of infection in Greece shortly after arrival is highly unlikely, given that no local transmission was documented in Athens during that period of time. In particular, the first imported cases in Greece were diagnosed on February 26 [5]. Similarly, in Israel there was only one case reported at that time. Further information collected by telephone showed that crew members on flight from Israel to Athens did not leave the airport gate after arriving from Athens to Tel Aviv and that they embarked shortly after arrival on a return flight. Therefore, exposure to local circulation of SARS CoV-2 in Israel, a country with only one case reported during that period, is extremely unlikely. However, exposure of the two pilgrim index cases in Jerusalem and subsequent in-flight spread of the disease can be justified considering that pilgrims constitute a high-risk group of travellers for acquisition of respiratory diseases [13] due to their exposure to crowded conditions and mixing with other people from different countries where local transmission of SARS-CoV-2 might had been documented. For this reason and in the interests of global safety, many mass gatherings have been suspended as a result of the pandemic [14].

Our extensive investigation revealed that in-flight transmission of SARS-CoV-2 most probably occurred and contributed to the importation of the virus in Greece. As the global epidemiology of COVID-19 evolves, many issues relevant to travellers will require ongoing update in terms of transmissibility, spread and vulnerability. Based on our findings, wearing masks on board by crew and passengers and exit temperature screening are justified. Prompt detection and isolation of symptomatic COVID-19 cases and implementation of appropriate measures in-flight are imperative for prevention of transmission.

Ethical approval

No ethical approval was required.

Author contribution

Pavli Androula: Investigation, Writing review & editing, **Smeti Paraskevi:** Investigation and writing, **Hadjianastasiou Sophia:** Investigation, **Theodoridou Kalliopi:** Writing review & editing, **Spilioti Athina:** Investigation, **Papadima Kalliopi:** Investigation and editing, **Andreopoulou Anastasia:** Investigation, **Gkolfinopoulou Kassiani:** Investigation and review, **Sapounas Spyros:** Investigation, **Spanakis Nikolaos:** Laboratory investigation and editing, **Tsakris Athanasios:** Laboratory investigation, review and editing, **Maltezou Helena C.:** Investigation, Writing review & editing

Declaration of competing interest

All authors declare no competing interests.

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