



Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

Unusual presentation of Middle East respiratory syndrome coronavirus leading to a large outbreak in Riyadh during 2017

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Key Words:
superspreading
renal failure
hemodialysis
Kingdom of Saudi Arabia
viral load

Background: The hallmark of Middle East respiratory syndrome coronavirus (MERS-CoV) disease is the ability to cause major health care-associated nosocomial outbreaks with superspreading events leading to massive numbers of cases and excessive morbidity and mortality. In this report, we describe a patient who presented with acute renal failure requiring hemodialysis and became a MERS-CoV superspreader, igniting a recent multihospital outbreak in Riyadh.

Material and Results: Between May 31 and June 15, 2017, 44 cases of MERS-CoV infection were reported from 3 simultaneous clusters from 3 health care facilities in Riyadh, Saudi Arabia, including 11 fatal cases. Out of the total reported cases, 29 cases were reported from King Saud Medical City. The cluster at King Saud Medical City was ignited by a single superspreader patient who presented with acute renal failure. After 14 hours in the open area of the emergency department and 2 hemodialysis sessions he was diagnosed with MERS-CoV. One hundred twenty contacts who had direct unprotected exposure were screened. Among those contacts, 9 out of 107 health care workers (5 nurses, 3 physicians, and 1 paramedic) and 7 out of 13 patients tested positive for MERS-CoV.

Conclusions: This hospital outbreak demonstrated the difficulties in diagnosing pneumonia in patients with renal and cardiac failure, which leads to delayed suspicion of MERS-CoV and hence delay in applying the proper infection control procedures. In MERS-CoV endemic countries there is an urgent need for developing rapid point-of-care testing that would assist emergency department staff in triaging suspected cases of MERS-CoV to ensure timely isolation and management of their primary illness and prevent major MERS-CoV outbreaks.

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Middle East respiratory syndrome Coronavirus (MERS-CoV) is a viral respiratory illness caused by a novel betacoronavirus that was first identified in the Kingdom of Saudi Arabia (KSA) in a businessman from Bisha who presented to Sulaiman Faqeeh Hospital in Jeddah with severe pneumonia and eventually died within 2 weeks

of admission during July 2012.¹ Since then, and as of January 28, 2018, the World Health Organization has been notified of 2,123 laboratory-confirmed cases of infection with MERS-CoV, with at least 740 deaths in 27 countries.² More than 85% of reported cases to date have been from countries of the Eastern Mediterranean region, with KSA carrying the major burden of outbreaks (n = 1,527 cases, including 624 deaths [40% of cases]).² The hallmark of this disease is the wide spectrum of presentation, ranging from completely asymptomatic to small family clusters of mild disease to major health care-associated nosocomial outbreaks with superspreading events leading to massive numbers of cases and excessive morbidity and mortality.³⁻⁵ Superspreading is a phenomenon well described in the

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Conflicts of interest: None to report.

public health literature that refers to the ability of certain individuals to infect a disproportionately large number of secondary patients relative to a typical infectious individual. In MERS-CoV, previous reports have attributed this phenomenon to either a very high viral load in the upper airway secretions of the index case (usually related to exposure to patients in the later stage of disease; that is, the second week of illness), excessive cough or aerosol-generating procedures, or/and delayed diagnosis and improper isolation of the index case due to other illnesses known to mask MERS-CoV clinical presentation (eg, chronic renal failure and chronic heart disease).⁶⁻⁹ In this report, we describe a patient who presented with acute renal failure requiring hemodialysis and became a MERS-CoV superspreader igniting a recent multihospital outbreak in Riyadh. We describe the outbreak at King Saud Medical City (KSMC).

OUTBREAK DETAILS

Between May 31 and June 15, 2017, 44 cases of MERS-CoV infection were reported in Riyadh, Saudi Arabia, including 11 fatal cases. Out of the total reported cases from the 3 simultaneous clusters from 3 health care facilities, 29 cases were reported from KSMC. The cluster at KSMC was ignited by a 46-year-old Yemeni man who presented to the emergency department (ED) through ambulance with cough, shortness of breath, and history of diarrhea for the past 2 days. He was afebrile with a temperature of 36.4°C. He denied any history of contact with camels or a MERS-CoV-positive patient. With this profile, his visual triage score was 5, which indicates the need for assessment for MERS-CoV suspicion. Visual triage scoring is a triaging system proposed by the Saudi Ministry of Health guidelines for management of patients with suspected MERS-CoV. It aims to filter patients who need to be assessed clinically, radiologically, for MERS-CoV suspicion and laboratory screening. The patient in this case had known diabetes and hypertension with a history of chronic bronchial asthma. Per the 5-level triaging system used at our ED, he was determined to be at level 2—in need of critical management (Canadian Triage and Acuity Scale¹⁰). On admission, his oxygen saturation was 93% on room air. His initial chest radiograph showed changes suggestive of pulmonary edema. The patient's initial bloodwork showed evidence of acute renal failure that required urgent hemodialysis. His clinical presentation and radiology findings were attributed to acute renal failure and the treating team did not consider MERS-CoV. The patient did not have any diarrhea symptoms throughout the course of his illness, but reported a 2-day history of diarrhea before admission. The patient spent more than 14 hours in the crowded open multibed ED where ventilation was neutral, through a central package air conditioning system (6 of 18 open recovery cubicles have a high-efficiency particulate air filter), after which he was shifted to a medical inpatient ward where he shared a normal pressure and ventilation parameters room with 4 other patients. Despite 2 hemodialysis sessions, his pulmonary edema decreased without remarkable improvement in his chest symptoms. After 2 days of admission, the patient experienced respiratory distress and hypoxia requiring intubation and admission to our intensive care unit where the team suspected MERS-CoV. The patient was then shifted to a negative pressure isolation critical care room with more than 12 air exchanges per hour. A nasopharyngeal swab was collected and tested at the Riyadh regional laboratory using real-time reverse-transcription polymerase chain reaction and found to be positive for MERS-CoV with positive results for both Orf1a and UP gene assays with cycle threshold (CT) value of 17 and the sample was negative for influenza. Mapping of the patient's journey inside the health care facility was carried out and dates and duration spent in different settings were documented (Fig 1). One hundred twenty contacts who had direct, unprotected exposure to the index patient were screened. Among those contacts, 107 were

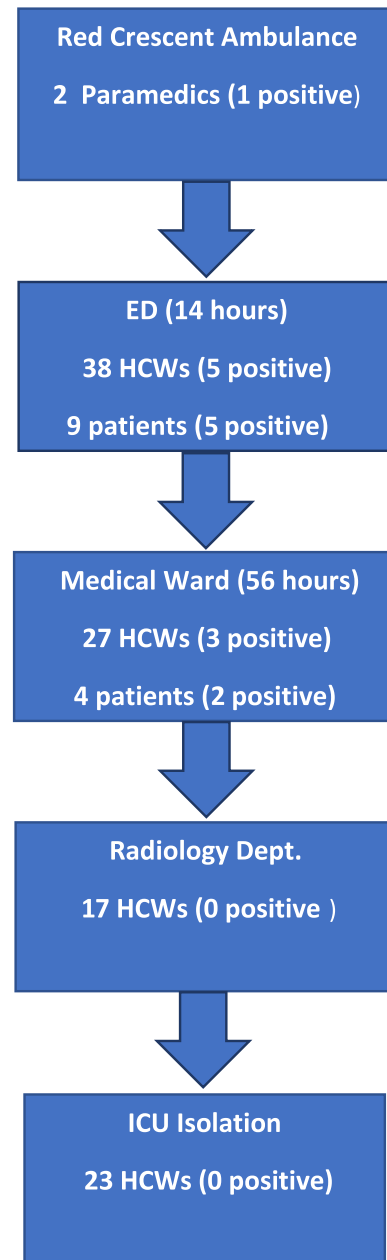


Fig 1. Mapping of the patient's journey with numbers of contacts. ED, emergency department; HCW, health care worker, ICU, intensive care unit.

health care workers among whom 9 tested positive for MERS-CoV. Five were nurses, 3 were physicians and 1 was a Saudi Red Crescent Authority paramedic who transferred the patient in the ambulance to the ED of KSMC. The other 13 contacts were patients, among whom 7 tested positive for MERS-CoV. One of those positive patients were reported in other health care facilities and linked to exposure history at KSMC. The spider chart in (Fig 2) represents the MERS-CoV outbreak; this reported superspreader patient (labeled "MA" in the center of the chart) was the index case for the outbreak.

The patient was transferred in stable condition to the allocated MERS-CoV regional reference center Prince Mohammed Bin Abdulaziz Hospital on the second day of his confirmed positive MERS-CoV status. During his stay at Prince Mohammed Bin Abdulaziz Hospital, screening for MERS-CoV was repeated twice, 1 week apart

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