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Major Article

Outcome of strict implementation of infection prevention control measures during an outbreak of Middle East respiratory syndrome

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Middle East Respiratory Syndrome (MERS)
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Background: The objective of this retrospective cohort study was to assess the impact of implementation of different levels of infection prevention and control (IPC) measures during an outbreak of Middle East respiratory syndrome (MERS) in a large tertiary hospital in Saudi Arabia. The setting was an emergency room (ER) in a large tertiary hospital and included primary and secondary MERS patients.

Methods: Rapid response teams conducted repeated assessments of IPC and monitored implementation of corrective measures using a detailed structured checklist. We ascertained the epidemiologic link between patients and calculated the secondary attack rate per 10,000 patients visiting the ER (SAR/10,000) in 3 phases of the outbreak.

Results: In phase I, 6 primary cases gave rise to 48 secondary cases over 4 generations, including a case that resulted in 9 cases in the first generation of secondary cases and 21 cases over a chain of 4 generations. During the second and third phases, the number of secondary cases sharply dropped to 18 cases and 1 case, respectively, from a comparable number of primary cases. The SAR/10,000 dropped from 75 (95% confidence interval [CI], 55-99) in phase I to 29 (95% CI, 17-46) and 3 (95% CI, 0-17) in phases II and III, respectively.

Conclusions: The study demonstrated salient evidence that proper institution of IPC measures during management of an outbreak of MERS could remarkably change the course of the outbreak.

Middle East respiratory syndrome (MERS) is an epidemic-prone viral disease with a high case fatality rate and ill-defined mode of transmission.[1-6] Currently, there is no safe and effective vaccine and chemoprophylaxis for the disease.[7] Major outbreaks of symptomatic MERS occurred in some major health facilities; these outbreaks were attributed to inadequate adherence of health care workers (HCWs) to infection prevention and control (IPC) guidelines.[8-10] Screening of HCWs and inpatients during outbreaks using polymerase chain reaction and serologic tests revealed more asymptomatic cases of MERS infections.[11] The role of HCWs with asymptomatic infections in further spreading the disease and amplification of outbreaks is not fully understood.[12] Preventing transmission of MERS in hospitals requires increased awareness of HCWs about the disease, triaging and isolation of patients who might have MERS infection, early detection, adherence to standard IPC procedures, and protocols and use of personal protective equipment (PPE), especially when performing aerosol-generating procedures.[6,13] Successful implementation of IPC measures depends on the presence of clear administrative policies and organizational leadership that promotes and facilitates adherence to IPC guidelines within the health care settings, including HCWs, patients, and visitors to the admitted patients.[14]

An outbreak of MERS occurred in an emergency room (ER) of a large tertiary hospital in Riyadh City (LTHR), Saudi Arabia; the ER

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has 150 beds and >1,000 HCWs.[12] The aim of this article is to demonstrate the outcome of strict implementation of IPC measures during the outbreak of MERS.

BACKGROUND

Materials and methods

The Ministry of Health of Saudi Arabia created a rapid response team (RRT) as part of its response to MERS outbreaks in public and private health care facilities in the Kingdom of Saudi Arabia. The main objective of the RRT is to ensure that all health care facilities are complying with Ministry of Health IPC guidelines and receive timely and appropriate technical support and supplies as deemed necessary. The RRT visits the health facilities, conducts independent assessments, audits IPC measures, and assesses the performances of the IPC team and HCWs. The RRT assesses the IPC performance within health facilities using a detailed structured checklist composed of 10 elements (approximately 125 specific observations). Each element is given a score of 0-2, depending on whether the health facility was fully, partially, or noncompliant. By the end of each visit, the RRT develops action plans with the hospital management to be immediately implemented.

According to the IPC guidelines, the hospital leadership is accountable for supporting the infection prevention activities that are relevant to the services provided and the patient populations cared for at the facility. The hospital ensures presence of ≥1 dedicated qualified IPC staff, adherence of HCWs to IPC measures, and presence of a designated triage area in the ER for suspected MERS that is physically separated from other areas in the ER. The IPC guidelines have a special section for collection of biologic specimens and for aerosol-generating procedures. Suspected MERS patients and other persons in the triage area (eg, persons accompanying suspected MERS patients) are instructed to wear facemasks and are placed in a separated area (by at least 1.5 m) from each other.

Demographic, epidemiologic, and clinical data about laboratory-confirmed MERS cases were obtained from the Health Electronic Surveillance Network of Saudi Arabia and LTHR paper and e-medical records of the patients. We used Microsoft Excel 2013 (Microsoft, Redmond, WA) for data entry; Epi Info 7 (Centers for Disease Control and Prevention, Atlanta, GA) was used for analysis of data and plotting epidemic curves for the outbreak. The collected data were used to construct 2 detailed chronologic time lines for each patient using 3- and 24-hour intervals to illustrate the dynamics of movements and outcome of patients throughout their stay in the hospital. We divided the outbreak into 3 phases based on the awareness of HCWs and implementation of IPC measures. At the beginning of the outbreak (phase I), there was inadequate awareness of HCWs at the LTHR about emergence of an outbreak of MERS in the hospital. When the hospital administration became aware about the increased number of MERS cases, additional but inadequate IPC measures were put in place (phase II). Toward the end of the outbreak (phase III), strict IPC measures were implemented. Then, the LTHR management decided to close the ER, suspend elective surgeries, and postpone all outpatient appointments and visits.[12] We obtained the number of patients that visited the ER seeking medical care during each phase of the outbreak. We calculated the crude secondary attack rate per 10,000 patients (SAR/10,000). SAR/10,000 was defined as the number of MERS cases that occurred within 14 days among patients visiting the ER for medical care after exposure to a primary or secondary case.

The RRT visited the LTHR 11 times during the outbreak: 5 times during phase II and 6 times during phase III. The RRT was not invited to visit the LTHR during phase I. The first assessment was conducted on August 6, 2015, and the last assessment was conducted on September 13, 2015. The RRT ascertained the level of awareness of HCWs of the case definition of a suspected case of MERS; presence of written IPC policies or guidelines for suspected or confirmed MERS patients; reporting, postexposure evaluation, and follow-up; and receipt of support of administration of the LTHR. The RRT also checked whether or not appropriate PPE for HCWs was made readily available in the ER at the LTHR. More HCWs were screened toward the end of the outbreak to alleviate and respond to a wave of panicking that swept the hospital, especially the staff working at the ER.

We used the time line, a well-defined algorithm, and the epidemiologic links to identify chains of secondary, tertiary, and quaternary generations of MERS cases that were acquired within the LTHR. Each chain of secondary cases was tracked back to a single primary case. We reviewed the medical records of each case (primary or secondary) admitted to the ER of LTHR to exclude exposure to MERS from a previous visit to the ER or other departments within the hospital where we conducted the study. Throughout the course of the outbreak, the LTHR screened 1,310 HCWs and inpatients for Middle East respiratory syndrome coronavirus (MERS-CoV). More details about the setup and workforce of the LTHR at the time of the outbreak are published elsewhere.[10]

RESULTS

Phase II (July 27-August 9)

The first RRT visit to the LTHR after the onset of the outbreak was on August 6, 2015 (ie, during phase II). The results of the assessments of the RRT during phases II and III are summarized in Table 1.

During the first visit to the ER, the RRT noted that the ER and the waiting area for the ER were overcrowded. There was no visual triaging for patients with respiratory infections and no specialized clinic for acute respiratory infections. Patients and escorts were close to each other (ie, <1 m from each other). A separate area was designated as a waiting area for suspected patients and their escorts. However, the waiting area was not controlled.

Some of the doctors serving at the ER did not know about the case definition of a suspected case of MERS and the appropriate IPC measures during management of suspected MERS cases. They were not aware of the potential risk of contracting MERS infection, of the high-risk procedures, and when they need to be tested and or abstain from work.

The HCWs were partially adhering to IPC guidelines because many HCWs were not putting on PPE when dealing with suspected MERS cases. Most nurses were using the same gowns and facemasks with all patients in the respiratory observation room. There was delayed admission and isolation of suspected MERS. Meanwhile, some HCWs were using double surgical masks. Others continued conducting their work in other patients' area without doffing their PPE. None of the HCWs used goggles or face shields. The availability of PPE was limited to the suspected isolation rooms. Some PPE (eg, N95 masks, face shield or goggles) was not readily available. HCWs were using aprons instead of gowns. Donning, doffing, and disposal of PPE was done incorrectly. There were no clear detailed instructions on what the HCW should do in case of suspecting MERS.

Nasopharyngeal swabs were taken in rooms without negative pressure. Cleaning workers were entering with all clean items and then providing the waste services with the same trolley. The LTHR has policies and guidelines on IPC but HCWs could not access MERS guidelines or were not even aware about them. Visual alerts (posters) were displayed in common waiting areas instructing HCWs to do IPC measures without specifying what should be done. There were IPC educational alerts for the patients visiting the ER seeking medical care, but in not in Arabic.