Natural History of Multidrug-Resistant *Acinetobacter baumannii* Carriage in Intensive Care Units

Acinetobacter baumannii typically causes infection among immunocompromised patients in intensive care units (ICUs).[1] In an effort to improve detection of this organism and reduce transmission, we recently validated a sensitive screening method to identify patients carrying multidrug-resistant (MDR) *A. baumannii* using a combination of sponge and selective culture media.[2] In that study, screening isolates from all the patients were MDR, as defined by nonsusceptibility to 3 or more classes of antimicrobials commonly used against this organism.[3] We subsequently implemented this method in the ICUs at one of our hospitals, with the following practical modifications to the original protocol: (1) only one sponge is used for sequentially swiping down the arm and leg, (2) broth enrichment is conducted for 4 hours before inoculation of the selective agar plate containing ceftazidime, and (3) the species is confirmed with Vitek2 (bioMérieux). Here, we report data on the natural history of MDR *A. baumannii* carriage in this patient population that were obtained through this initiative.

The active screening program was implemented in 3 ICUs (medical, burn, and cardiovascular ICUs; total of 54 beds) at University of Pittsburgh Medical Center (UPMC) Mercy Hospital in Pittsburgh, Pennsylvania, from June 2010 through May 2011. The initiative was approved by the UPMC quality improvement review committee. All patients who were admitted to the ICUs underwent active screening for MDR *A. baumannii* at admission and every 7 days thereafter as prompted by the electronic ordering system. Patients who were newly identified as having positive culture results were placed under contact isolation, but attempts at decolonization were not made. All the screening culture results as well as clinical cultures that grew MDR *A. baumannii* were collected from the microbiology database and matched with the corresponding admission data. For the purpose of this analysis, MDR *A. baumannii* was defined as *A. baumannii* with nonsusceptibility to ceftazidime. When a patient's culture results changed from positive to negative or vice versa during the same hospitalization, the midpoint of the 2 dates was calculated and used to calculate the number of carriage-positive days. For patients with culture results that changed from positive to negative and then changed to positive again, 2 consecutive negative cultures were required to define clearance and subsequent recolonization because of the approximately 80% sensitivity of the screening method.[2] The minimum duration of carriage was calculated as time from the first positive culture result (or the midpoint between the first positive culture result and the last negative culture result before the first positive result was obtained, if present) to the last positive culture result (or the midpoint between the last positive culture result and the last negative culture result after the last positive culture result was obtained, if present). The estimated duration of carriage was calculated likewise, except that the patients were considered to be carriers until discharge from the ICUs if the last positive culture result was not followed by a negative culture result. Fisher's exact test was used to determine statistical significance.

A total of 86 unique patients accounted for 118 ICU admissions associated with at least 1 screening or clinical culture positive for MDR *A. baumannii* during this period. MDR *A. baumannii* was identified by screening cultures only in 56 of 118 cases, by clinical cultures only in 6 cases, and by both screening and clinical cultures in 56 cases. Of those cases in which both screening and clinical cultures revealed MDR *A. baumannii*, it was identified by screening cultures first in 26 cases and by screening and clinical cultures on the same day in 17 cases. Overall, in 82 (69.4%) of the 118 cases, MDR *A. baumannii* carriage was initially identified by screening cultures. The mean length of stay in the ICU was 15.4 days, and the median length of stay was 10 days (range, 0–141 days). The mean length of stay until the first positive culture result was 2.5 days, and the median length of stay was 0 days (range, 0–40.5 days). Of the 118 cases, 84 (71.2%) had a culture positive for MDR *A. baumannii* obtained within 1 day of ICU admission. The rate was 80.1% for cases involving patients with and 67.1% for cases involving patients without another ICU admission within the previous month ($P = .19$). The mean minimum duration of carriage was 8.5 days, and the median duration was 3.5 days (range, 0–63 days). The mean estimated duration of carriage was 10.8 days, and the median duration was 6.3 days (range, 0–63 days). The total minimum and estimated durations of carriage corresponded to 55.2% and 70.5% of the total ICU days, respectively (Figure 1). For over half of the cases, the estimated duration of carriage exceeded 90% of the respective ICU days. Only 19.5% of the

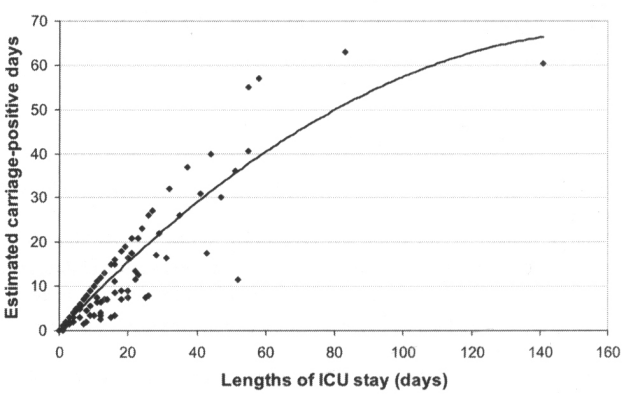

FIGURE 1. Lengths of intensive care unit (ICU) stay for patients with cultures positive for multidrug-resistant *Acinetobacter baumannii* and their estimated carriage-positive days. The curve represents second-order polynomial regression.

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cases were associated with a negative screening culture result documented before discharge from the ICU.

Although long-term carriage of MDR *A. baumannii* has been reported,[4] this is, to our knowledge, the first study to quantify the duration of carriage of this organism in ICUs. Our data suggest that, at least in nonoutbreak settings, importation by patients who were colonized elsewhere constitutes the main source of this organism in ICUs, and thus screening cultures obtained at admission are likely to be more cost-effective than subsequent screening cultures. Also, the carriage-positive days accounted for the majority of the total ICU days, with only 19.5% of the carriers apparently clearing carriage before discharge from the ICU.

Our study has several limitations. We could not define the carriage status at discharge from the ICU for all patients, because discharge cultures were not routinely obtained. Also, the program was limited to ICUs, and we do not have information on the long-term carriage status of patients hospitalized in other units before and after ICU stay.

In summary, the majority of MDR *A. baumannii* carriers can be identified by active screening at admission to ICUs, and they should be considered as carriers throughout their ICU stay, at least in the absence of additional interventions, such as decolonization.

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