



ELSEVIER

Contents lists available at ScienceDirect

## American Journal of Infection Control

journal homepage: [www.ajicjournal.org](http://www.ajicjournal.org)

## Major Article

## Healthcare-associated infections in the neurological intensive care unit: Results of a 6-year surveillance study at a major tertiary care center

Yasser B. Abulhasan MBChB, FRCPC <sup>a,b,\*</sup>, Susan P. Rachel RN <sup>c</sup>,  
 Marc-Olivier Châtillon-Angle SRT <sup>d</sup>, Najayeb Alabdulraheem MD <sup>e</sup>, Ian Schiller MSc <sup>f</sup>,  
 Nandini Dendukuri PhD <sup>f</sup>, Mark R. Angle MD <sup>a</sup>, Charles Frenette MD <sup>g</sup>

<sup>a</sup> Neurological Intensive Care Unit, Montreal Neurological Institute and Hospital, McGill University, Montreal, Quebec, Canada

<sup>b</sup> Faculty of Medicine, Health Sciences Center, Kuwait University, Kuwait, Kuwait

<sup>c</sup> Infection Prevention and Control Department, Montreal Neurological Institute and Hospital, McGill University Health Center, Montreal, Quebec, Canada

<sup>d</sup> Clinical Research Unit, Montreal Neurological Institute and Hospital, McGill University, Montreal, Quebec, Canada

<sup>e</sup> Department of Neurology and Neurosurgery, Montreal Neurological Institute and Hospital, McGill University, Montreal, Quebec, Canada

<sup>f</sup> Division of Clinical Epidemiology, McGill University Health Centre—Research Institute, Montreal, Quebec, Canada

<sup>g</sup> Infectious Disease Department, McGill University Health Center, Montreal, Quebec, Canada

## Key Words:

Nosocomial infections

Critical care

Pneumonia

Ventilator-associated pneumonia

Urinary tract infections

Ventriculostomy-associated infections

**Background:** Healthcare-associated infections (HAIs) occur frequently in neurological intensive care units (neuro-ICUs); however, data differentiating associations with various diagnostic categories and resulting burdens are limited. This prospective cohort study reported incidence rates, pathogen distribution, and patient-related outcomes of HAIs in a neuro-ICU population from April 2010 to March 2016.

**Methods:** Laboratory results and specific clinical indicators were used to categorize infections as per National Healthcare Safety Network nosocomial infection surveillance definitions. Patient outcomes studied included length of stay and mortality.

**Results:** There were 6,033 neuro-ICU admissions resulting in 20,800 neuro-ICU days over the 6-year study period. A total of 227 HAIs were identified for a rate of 10.9/1,000 ICU days. Device-associated infections accounted for 80.6% of HAIs, with incidence rates (per 1,000 device days) being 18.4 for ventilator-associated pneumonia; 4.9 for catheter-associated urinary tract infections (CAUTIs); 4.0 for ventriculostomy-associated infections; and 0.6 for central line-associated blood stream infections (CLABSIs). Of the various diagnostic categories, subdural hematoma and intracerebral/intraventricular hemorrhage were associated with the highest pooled HAIs, with incidence rates of 21.3 and 21.1 per 1,000 neuro-ICU days, respectively. Prolonged neuro-ICU length of stay was strongly associated with all HAIs.

**Conclusions:** This large-scale surveillance study provides estimates of the risk of common HAIs in neurocritical care patients and their effect on hospitalization. Preventive strategies kept rates of infection very low, in particular CAUTI, CLABSI, and *Clostridium difficile* infections, and inhibited the emergence of resistant organisms.

© 2017 Association for Professionals in Infection Control and Epidemiology, Inc. Published by Elsevier Inc. All rights reserved.

## BACKGROUND

Healthcare-associated infections (HAIs) are a significant cause of morbidity and mortality,<sup>1</sup> affecting an estimated 1 in 20 patients during their hospitalized care. In intensive care units (ICUs), incidence

rates are further increased, affecting approximately 30% of patients.<sup>2,3</sup> HAIs are generally associated with the severity of the medical condition, length of stay, and use of invasive medical devices.<sup>4,5</sup> This is of pronounced significance in the field of neurocritical care, as prolonged use of multiple invasive devices is common in patients with acute severe neurological injuries who tend to require extended ICU care.

Surveillance of HAIs is recommended as part of an effective infection control program. Although published data using Centers for Disease Control and Prevention/National Healthcare Safety Network (CDC/NHSN) definitions for HAIs in general and for device-associated

\* Address correspondence to Yasser B. Abulhasan, MBChB, FRCPC, Faculty of Medicine, Health Sciences Center, Kuwait University, PO Box 24923, Safat-13110, Kuwait.  
 E-mail address: [yasser.abulhasan@hsc.edu.kw](mailto:yasser.abulhasan@hsc.edu.kw) (Y.B. Abulhasan).

Conflicts of interest: All authors report no conflicts of interest relevant to this study or financial support.

infections (DAIs) in particular exist, the resulting burden on patient hospitalization course and outcomes in the neurocritical care setting is not fully known.<sup>6-13</sup> Based on NHSN data from 2010 to 2013,<sup>14-17</sup> neurosurgical and neurological ICU-documented DAI rates ranged from 3.0 to 5.3 (per 1,000 urinary catheter-days) for catheter-associated urinary tract infections (CAUTIs); from 2.1 to 4.8 (per 1,000 ventilator-days) for ventilator-associated pneumonia (VAP); and from 0.9 to 1.3 (per 1,000 central line-days) for central line-associated bloodstream infections (CLABSIs). Despite their significant value, these data are limited by the fact that they do not differentiate between the various neurocritical emergencies. In addition, device utilization (DU) ratios and infection rates associated with ventriculostomy devices, which are frequently used in neurocritical care patients and can result in both ventriculitis and meningitis,<sup>18</sup> are unfortunately not reported in a similar manner.

To address these gaps in the literature, we studied incidence rates, pathogen distribution, and patient-related outcomes of HAIs in a neurological intensive care unit (neuro-ICU) patient population over a 6-year period.

## METHODS

### Study design and population

In 2009, we initiated a prospective surveillance system to identify all nosocomial infections at the (Montreal Neurological Institute and Hospital), including the neuro-ICU. We report here the 6-year cumulated data of clinical evidence and outcomes of ICU-acquired HAIs for each patient's ICU stay up to 48 hours after ICU discharge. Definitions were adapted from the CDC/NHSN surveillance definitions<sup>19</sup> and from the mandatory Surveillance Provinciale des Infections Nosocomiales in Quebec, Canada.<sup>20</sup> Our exclusive neurosciences academic institution has a dedicated neuro-ICU with 12-14 active beds (4 single-patient rooms, 2 2-patient rooms, and 6 ward-type beds) staffed by trained intensivists and provides comprehensive management for both neurosurgical and neurological ICU patients. This setup is unique in the Quebec region. Our institution receives transfers from surrounding hospital emergency rooms

and ICUs, covering a population of 1.2 million, and was located beside a 400-bed tertiary care adult teaching hospital with a shared emergency room. In April 2015, however, the tertiary care hospital moved sites, and our institution became a standalone facility. Invasive procedures, including central venous catheters (CVCs), Foley catheters, and external ventriculostomy drains (EVDs), are performed by ICU staff, nursing staff, and neurosurgeons, respectively.

All patient admissions resulting in at least 1 overnight neuro-ICU stay were included between April 1, 2010, and March 31, 2016. Admissions where the patient was discharged from the neuro-ICU on the same calendar day were excluded, as the neuro-ICU often serves as a recovery room after neurosurgical procedures.

### Patient characteristics and outcome

Variables collected included demographics, main diagnoses (ICD-10-CA 2008, 2012, and 2015 revisions) and main interventions (Canadian Classification of Health Interventions), neuro-ICU and hospital length of stays, and in-hospital mortality. Based on all available discharge and radiography records, all patients were retrospectively assigned by a single investigator to 1 of 15 diagnostic categories, as presented in Table 1. Neuro-ICU device-specific denominator data, including patient-days and various device-days, were collected by trained healthcare personnel. Additional variables, including comorbidities, immune status, physiology on admission, and management course, were recorded for patients with HAIs.

Variables collected for each episode of ICU-acquired HAI included date of infection, pathogens and associated microorganisms, available susceptibility, antibiograms, and antimicrobial treatment. The outcome of patient (survived or demised) censored at 60 days after the infection episode was collected. All-cause 30-day mortality was defined as the time from infection to death in patients with HAI, irrespective of the primary cause of mortality.

### Surveillance

HAIs were identified by using a combination of information-gathering methods. All microbiological reports are reviewed daily

**Table 1**

Neuro-ICU length of stay, admissions, and rates of infection by diagnostic category

Diagnostic category	ICU length of stay, days		ICU admissions	Pooled healthcare-associated infections
	Total (%)	Median (IQR)	Total (%)	Total [rate] <sup>†</sup>
Subarachnoid hemorrhage	5123 (24.6)	10 (3-19)	429 (7.1)	79 [15.4]
CNS neoplasm	3927 (18.9)	1 (1-2)	2030 (33.6)	9 [2.3]
ICH/IVH	2697 (13)	3 (1-7)	461 (7.6)	57 [21.1]
Post-operative/intervention	2057 (9.9)	1 (1-1)	1456 (24.1)	7 [3.4]
Ischemic stroke/TIA	1304 (6.3)	2 (1-3)	402 (6.7)	19 [14.6]
Neuromuscular/demyelinating/MND	1173 (5.6)	3 (1-11)	145 (2.4)	17 [14.5]
CNS infections	1101 (5.3)	2 (1-6)	171 (2.8)	6 [5.4]
Medical complications	787 (3.8)	3 (1-8)	156 (2.6)	5 [6.4]
Other neurovascular diseases/surgeries	659 (3.2)	1 (1-3)	205 (3.4)	2 [3]
Seizure/status epilepticus	607 (2.9)	2 (1-4)	182 (3)	10 [16.5]
Subdural hematoma	469 (2.3)	2 (1-4)	138 (2.3)	10 [21.3]
Other diagnoses	455 (2.2)	1 (1-3)	154 (2.6)	4 [8.8]
Neurological readmissions*	366 (1.8)	3 (1-7)	83 (1.4)	2 [5.5]
Spinal cord disease	36 (0.2)	2.5 (1-7)	8 (0.1)	0
Traumatic brain injury	39 (0.2)	2 (1-4)	13 (0.2)	0
Total (n)	20,800			<b>227 (13)<sup>‡</sup></b>
Pooled rate per 1,000 days				<b>10.9</b>

CNS, central nervous system; ICH, intracerebral hemorrhage; IQR, interquartile range; IVH, intraventricular hemorrhage; MND, motor neuron diseases; TIA, transient ischemic attack.

\*Neurological readmissions were defined as admissions where a patient was initially discharged from the Neuro-ICU with a principal diagnosis but required readmission to the ICU for another neurological emergency.

<sup>†</sup>[rate] per 1,000 days.

<sup>‡</sup>(secondary bacteremia).

Download English Version:

<https://daneshyari.com/en/article/8566539>

Download Persian Version:

<https://daneshyari.com/article/8566539>

[Daneshyari.com](https://daneshyari.com)