Journal of Hospital Infection 87 (2014) 152–158

Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevierhealth.com/journals/jhin

Comparison of intensive-care-unit-acquired infections and their outcomes among patients over and under 80 years of age

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ARTICLE INFO

Article history:
Received 11 December 2013
Accepted 27 March 2014
Available online 29 April 2014

Keywords:
Intensive care unit
ICU-acquired infection
Elderly
Outcome
Risk factors

SUMMARY

Background: Patients aged >80 years represent a growing population admitted to intensive care units (ICUs). However, little is known about ICU-acquired infection (IAI) in this population, and the rate of invasive procedures is increasing.
Aim: To evaluate the frequency and effects of IAI in elderly (≥80 years) and younger patients.
Methods: Retrospective evaluation of consecutive patients hospitalized for three days or more over a three-year period in an 18-bed ICU in an academic medical centre.
Findings: Elderly patients represented 18.9% of the study population. At admission, the mean number of organ dysfunctions was similar in elderly and younger patients. The use of invasive procedures was also similar in elderly and younger patients, as follows: invasive mechanical ventilation for more than two days, 67.4% vs 55%; central venous catheterization, 56.9% vs 51.4%; and renal replacement therapy, 17.6% vs 17.8%, respectively. The frequency of IAI was 16.5% in elderly patients and 13.9% in younger patients ($P = 0.28$), with 20.5 vs 18.9 IAI episodes per 1000 ICU-days, respectively ($P = 0.2$). A Cox model identified central venous catheterization and invasive mechanical ventilation for more than two days as independent risk factors for IAI. The associations between IAI and prolonged ICU stay, increased nursing workload, and ICU and hospital mortality rates were similar in elderly and younger patients.
Conclusions: The frequency of IAI was similar in elderly and younger patients, as were the associations between IAI and length of ICU stay, nursing workload and ICU mortality in an ICU with a high rate of invasive procedures.

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0195-6701/$ – see front matter
http://dx.doi.org/10.1016/j.jhin.2014.03.011

Introduction

The population is aging and life expectancy is increasing worldwide.[1] Increasing evidence indicates that patients aged >80 years deserve admission to intensive care units (ICUs).[2] Despite a high rate of refusal, these patients still represent more than 10% of ICU admissions.[3] The characteristics and outcomes of these patients are now better documented.[3–7] However, very few studies have focused on ICU-acquired infection (IAI) in this population, and the results are scarce and controversial.[8,9] Until recently, elderly patients admitted to ICUs received less intensive treatment [invasive mechanical ventilation (IMV), renal replacement therapy (RRT), etc.] than younger patients, even after adjustment for disease severity.[10] Lerolle *et al.* showed that increased intensity of care for elderly patients was associated with improved survival.[11] In order to assess the effect of increased intensity of care, this study evaluated the frequency and consequences of IAI in patients aged ≥80 years admitted to an ICU with a high rate of invasive procedures, and compared these results with those for younger patients.

Patients and methods

Setting and participants

All consecutive patients admitted to the study ICU (18 beds) over a three-year period (from 1st January 2003 to 31st December 2005), and exposed to the risk of in-hospital infection (ICU stay of three days or more) were studied. There were no exclusion criteria other than length of ICU stay.

The following patient data were extracted from the hospital's electronic database: age; sex; referring unit; previous health status according to the Knaus classification;[12] severity of underlying medical conditions stratified according to McCabe and Jackson's criteria;[13] Simplified Acute Physiology Score II (SAPS II) at admission;[14] and number(s) and type(s) of organ dysfunctions according to the Organ Dysfunction and INfection (ODIN) model at admission.[15] Therapeutic activity was evaluated using the Omega score, which is considered to be a reliable indirect evaluation of nursing workload.[16,17]

The durations of IMV, arterial catheterization, central venous catheterization, indwelling bladder catheterization (IBC) and RRT were recorded. Length of ICU stay, interval from admission to diagnosis of the first infection, responsible pathogens, and ICU and hospital mortality rates were also recorded.

Definitions

Infection control throughout the hospital is coordinated by a nosocomial infection control committee that prospectively records all episodes of pneumonia, urinary tract infection (UTI), bacteraemia, catheter-related infection (infection involving arterial and/or venous central line) and other infections (sinusitis, cellulitis, colitis, surgical infection), and validates them independently every month. All IAIs were reviewed and validated by the authors. IAI definitions did not change throughout the study period.

Patients with new and persistent lung infiltrates on chest X-ray and with macroscopically purulent tracheal secretions underwent fibre-optic bronchoscopy. Nosocomial pneumonia was diagnosed based on positive quantitative broncho-alveolar lavage cultures, with at least one micro-organism recovered at a significant concentration [$\geq 10^4$ colony-forming units (cfu)/mL].[18,19] Catheter-related infection was defined as a semi-quantitative tip culture yielding $\geq 10^3$ cfu/mL.[20] Bacteraemia related to skin flora was validated if two or more blood cultures isolated the same pathogen (e.g. coagulase-negative staphylococci). UTI was defined as the association of pyuria (≥10 white blood cells/mm^3) and a urine culture containing $\geq 10^5$ cfu/mL. Other infections were recorded following the recommendations of the Centers for Disease Control and Prevention (CDC).[21]

Preventive methods

In accordance with CDC recommendations, measures applied to prevent intravascular-catheter-related infection during catheter insertion were handwashing, full barrier precautions and cleansing of the skin with 2% alcoholic chlorhexidine. A transparent semipermeable dressing was placed and changed every 72–96 h, or if it was soiled or loosened. The need for catheterization was evaluated daily, and any unnecessary catheters were removed. The catheter insertion site was monitored daily. Upon removal, each catheter tip was cultured.[22] Standard precautions (handwashing and gloves for handling respiratory secretions) were used to prevent nosocomial pneumonia, along with 30–45° elevation of the head of the bed, routine oropharyngeal cleaning (every 4–6 h) and decontamination with an antiseptic agent.[23] CDC recommendations for the prevention of catheter-associated UTI were followed.[24]

Over the study period, ICU admission was based on the need for artificial support, previous health status, underlying diseases and patients' wishes, regardless of the patient's age.

The local electronic database was approved by the French National Commission for Informatics and Liberty (Commission Nationale Informatique et Liberté). In accordance with French law, informed consent was not required because of the epidemiological nature of the study.

Statistical analyses

Unless stated otherwise, results are expressed as mean ± standard deviation or *N* (%). Between-group comparisons used unpaired Student's *t*-test or Mann–Whitney test for continuous variables, and Chi-squared test for categorical variables, as appropriate. All tests of significance were two-tailed. $P < 0.05$ was considered to indicate statistical significance. Multi-variate analysis with a Cox proportional hazards model was used to evaluate potential risk factors for IAI for each age group. Variables associated with IAI in the univariate analysis with $P < 0.05$ were entered into the Cox model. Due to collinearity between SAPS II and ODIN number of organ dysfunctions, SAPS II and ODIN types of organ dysfunction were entered into the Cox model, but ODIN number of organ dysfunctions was not included. Hazard ratios (HR) and 95% confidence intervals (95% CI) were calculated for all significant predictors of IAI risk. Analyses were computed with StatView Version 5.0 (SAS Institute Inc., Cary, NC, USA).