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EDITORIAL

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Invasive devices: no need? No use!

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Nosocomial infection remains the most frequent complication associated with hospitalization, presenting a serious burden in terms of health care costs, morbidity, and possibly also mortality [1, 2]. Especially intensive care unit (ICU) patients are at risk of infection because of their decreased immune status due to an often debilitated physical condition and exposure to numerous invasive procedures. Therefore surveillance of nosocomial infections is of utmost importance when considering quality control in ICUs. Strict follow-up of the incidence of some of the most prevalent infections (pneumonia, bacteremia, urinary tract infection, surgical site infection) is essential to assess the quality of infection control and to evaluate the value of interventions introduced to minimize the threat of hospital-acquired infection.

In *Intensive Care Medicine* van der Kooi et al. [3] now describe the results of a 4-year surveillance of nosocomial infections in 19 Dutch ICUs. The authors focused on device-associated infections. This is a good choice, because these infections constitute a substantial proportion of infectious episodes, and because the incidence of device-associated infections is a good quality-of-care indicator. In addition, device-associated infections can be expressed per 1,000 device-days, which is far more discriminating than expressing infection rates per 1,000 days in the ICU or per 1,000 ICU admissions [4, 5]. Only the use of a denominator expressing a fixed number of days at risk (device-days) can allow a fair interpretation of trends in infection rates over longer periods of time.

In their study van der Kooi et al. [3] found that duration of device use was a risk factor for device-associated infection. It seems quite logical that infection risk increases with exposure time to the factor inherently associated with the infection itself. The relationship between exposure time and likelihood of infection has been repeatedly described [6, 7, 8]. Although the finding of van der Kooi et al. is not surprising, the message remains of great importance. In addition to strict hand hygiene, limiting the number of device-days is a top priority for reducing nosocomial infections. Successful interventions are those succeeding in reducing the length of endotracheal intubation or catheterization. Reduction in length of ventilation by only 1 or 2 days substantially decreases the probability of ventilator-associated pneumonia (VAP) [7, 8]. A proactive weaning protocol may serve this goal [9]. Berentholtz et al. [10] nearly eliminated catheter-related bloodstream infection (CR-BSI) by the introduction of a multifaceted intervention program. Increasing the awareness of the problem and assessing daily the possibility of removing the catheter were major steps in this successful program.

van der Kooi et al. did not found higher mortality among patients with VAP or CR-BSI and catheter-associated urinary tract infections after adjusting for confounding factors. On the other hand, number of device-days was an independent predictor of fatal outcome.

Caution is warranted by such a statement. It must be noted that regression models do not indicate causality. Why should patients die because of being catheterized for a longer period, especially while CR-BSI does not contribute to mortality? Number of days at risk is often considered a major confounder in outcome studies, but this does not mean that it necessarily results in worse outcomes [11]. A longer need for ICU stay, devices used, and a higher mortality are far more likely the result of critical underlying conditions. The value of analyses linking device-days with mortality can be questioned as their relevance is tiny and they are prone to misinterpretation.

More intriguing is the relationship between the infection itself and mortality. The observation that CR-BSI does not significant increase mortality has been well addressed previously [1, 12]. There is ore discussion about excess mortality of pneumonia. van der Kooi et al. show that patients with VAP do not have a higher mortality. In general the mortality attributable to VAP ranges from 5% to 50% [6]. Several factors may explain these differences. Firstly, the diagnosis of VAP remains a tricky issue [13]. Although widely used, the definition published by the Centers for Disease Control include wide room for interpretation and may result in the inclusion of patients meeting the definition only in a borderline fashion. The definitions proposed by the International Sepsis Forum offer a more solid basis for identifying patients with pneumonia [14]. The fact that patients are classified as having possible, probable, or confirmed pneumonia in a post-hoc manner does not hamper their use for surveillance purposes. Secondly, given the numerous confounding factors in nosocomial infections and outcome, matching criteria may affect the results a matched cohort study [11]. Matched cohort studies in which matching criteria include a severity of disease score are more likely to demonstrate rather small attributable mortality rates than those in which matching is based on more general characteristics such as age, gender, and length of hospitalization [1, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25]. Thirdly, quality of care is essential for optimizing the odds for survival. In particular, early recognition of sepsis followed by appropriate antimicrobial therapy in terms of timely initiation, pathogen coverage, correct dosing, and route [26, 27, 28, 29].

In any case, whether nosocomial infections do contribute to increased death does not cast doubt on the need for careful monitoring. Efforts to reduce the incidence of infections remain essential because of associated excesses in morbidity, length of ICU stay, and health care resources use [6, 12, 30].

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