



Pros: should universal decolonization be performed routinely for critically ill patients?

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Abstract: Healthcare-associated infections (HAI) are associated with long hospital stay, increased rates of death and costs. Critically ill patients always suffer several invasive treatments and immunocompromise which increase the risk of infection. Universal decolonization is an important strategy to prevent HAI. We will discuss the effects of universal decolonization on preventing HAI.

Keywords: Healthcare-associated infections (HAI); universal decolonization; critically ill patients; intestinal dysbiosis; hand hygiene (HH); antibiotic stewardship

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Healthcare-associated infections (HAI) are associated with long hospital stay, increased rates of death and costs (1,2). Critically ill patients always suffer several invasive treatments which could injury the integrity of skin mucosal, and more critically ill patients have immunocompromise, which increase the risk of infection. Universal decolonization is an important strategy to prevent HAI, such as chlorhexidine bathing, hand hygiene (HH), reverse Intestinal dysbiosis and antibiotic stewardship (3,4).

Chlorhexidine bathing reduces incidence of infection in ICU

Chlorhexidine bathing decreases the risk of bacterial infection. In medical ICU, daily chlorhexidine bathing could decrease incidence density of methicillin-resistant staphylococcus aureus (MRSA) and hospital-associated *vancomycin-resistant Enterococcus (VRE)* (5,6). In surgical ICU, bathing with 2% chlorhexidine could decrease the risk of HAI by 44.5% (7). Compared with targeted decolonization (i.e., screening, isolation, and decolonization

of MRSA carriers), universal decolonization decreased MRSA culture and bloodstream infection (3). Although a pragmatic cluster-randomized, cross-over study found bathing with chlorhexidine did not reduce the incidence of HAI (4), there are several limitations in this study, first, the study could not be blinded to the chlorhexidine bathing group and the compliance didn't be monitored; second, end point chosen in this study could be challenged, the effect of daily chlorhexidine bathing on the end point are influenced by several clinical factors, and is relatively weak; third, the overall HAI rates were relatively low (8).

Intestinal dysbiosis needs universal decolonization but not antibiotics

There are numerous bacteria in the gut that do not have any adverse effects. Bacteria barrier is one of the most important barrier of the intestinal epithelium (9). Critically ill patients always have acute gastric injury (AGI) with intestinal dysbiosis. Intestinal dysbiosis could induce bacteria proliferate, luminal bacteria become virulent and injury immune barrier.

Early nutrition (EN) improves intestinal function

EN could not only improve intestinal movement, decrease adherence of microorganisms on intestinal epithelium, decrease bacteria toxin and reduce colonization of pathogenic bacteria, but stimulate intestinal blood flow, maintain intestinal structural integrity and supporting the mass of secretory IgA producing immunocyte (10). The benefits of EN are equal to intestinal universal decolonization.

EN improves prognosis of critically ill patients. A meta-analysis of 21 randomized controlled trials (RCT) compared the provision of early EN versus delayed EN, early EN was associated with a significant reduction in mortality (RR =0.70; 95% CI, 0.49–1.00; P=0.05) and infectious morbidity (RR =0.74; 95% CI, 0.58–0.93; P=0.01) (11). American Society for Parenteral and Enteral Nutrition guideline recommend that early EN should be initiated within 24–48 hours in the critically ill patient who is unable to maintain volitional intake (11).

Probiotics reverse intestinal dysbiosis

Critically ill patients are at high risk for intestinal dysbiosis with high rates of broad spectrum antibiotic use, stress of critical illness, and disease related with intestinal ischemia (12). Probiotics are living microbes, can colonize gastrointestinal tract and be benefits to the patients (13). Probiotic therapy leads to several beneficial effects including augmented release of antimicrobial peptides, IgA production, regulation of immune cell proliferation, reduced gut cell apoptosis and anti-oxidative activity (14).

Probiotics play the role of universal decolonization. The meta-analysis of 14 RCT found that probiotic therapy could reduce the incidence of ventilator associated pneumonia (RR =0.74, 95% CI, 0.61–0.90, P=0.002), and infectious complications in the ICU (RR =0.80, 95% CI, 0.68–0.95, P=0.009) (15). According to Canadian Clinical Practice Guidelines, probiotics should be considered to use in critically ill patients (16).

Universal decolonization is not only patients, but health care staff

Prevention and control of infections have saved a lot of people's lives, it is also important to protect critically ill patients from HAI.

HH is the important strategy to prevent HAI

HH has been accepted as a crucial component of infection prevention (17). HH has in addition the benefit of being effective for reducing transmission of many resistant or susceptible bacteria. A cost-effectiveness analysis using a Markov model found that universal decolonization include HH is less costly and more effective than screening and isolation of MRSA prevention strategy (18). HH is not only effective on MRSA, but for extended-spectrum beta-lactamase-producing *Enterobacteriaceae* (ESBL-PE) spread. A cost-effectiveness analysis based on dynamic, stochastic transmission model showed that the overall costs (cost of intervention and infections) were the lowest for HH compliance improvement from 55%/60% before/after contact with a patient to 80%/80% (19). HH is effective on HAI prevention, but it depends on compliance improvement.

Antibiotic stewardship is associated with decreasing inappropriate antibiotics usage

Multi-drug-resistant organisms (MDRO) were frequently found in ICU and near half of empiric gram-negative therapy was inappropriate (20). Antimicrobial exposure increases various drug-resistant organisms (21). Numerous studies have demonstrated the association between the use of antimicrobial and MDRO detection (22). Inappropriate therapy was associated with higher costs and long ICU stay (20). Ma *et al.* conducted a pre-post study and the results showed that the proportion of patients colonized or infected with MDRO decreased along with antimicrobial stewardship (23). A network meta-analysis found that strategies with antimicrobial stewardship program as a core component showed a significant reduction the acquisition of ESBL-PE (24). Antibiotic stewardship is useful to reduce the consumption of antibiotics and the acquisition of MDRO.

Concepts of universal decolonization have developed, the contents include patients, health care workers and infection control. Chlorhexidine bathing, intestinal dysbiosis reverse, HH and antibiotic stewardship have proved be benefit of critically ill patient infection control, more strategies need further studies clarify.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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