SINGLE PALLIATIVE CARE ROOMS ON THE CONTROL OF INFECTIONS IN SEVERE TRAUMATIC BRAIN-INJURED PATIENTS: A RETROSPECTIVE STUDY

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ABSTRACT

***Background**: Nosocomial infections are associated with an increased length of stay in intensive care units. Bacteria resistant to broad-spectrum antibiotics may infect patients who have long-term stays in ICUs. We aim to investigate whether private rooms in palliative care are effective or not in controlling infections in patients who have long-term stays in intensive care units.*

***Methods**: In-patients' databases in the palliative care ward with eleven single rooms at Ulus State Hospital, Ankara, Turkey, between December 2012 and November 2013, were retrospectively analysed for detailed microbiological data. Inclusion criteria were: adult trauma patients involved in motor vehicle collisions; those who had severe brain injury; those on mechanical ventilator support during long-term stays in intensive care unit (>25 days), and thereafter, admitted to the palliative care ward; those who were vegetative; those who had permanent tracheostomy and percutaneous endoscopic gastrostomy tube. Patients having cancer, diabetes mellitus and an age of <18 or >65 were excluded from the study.*

***Results**: There were 292 patients who stayed in the palliative care ward between December 2012 and November 2013. A total of 14 patients, 8 male and 6 female (age 18-63 years) met inclusion criteria. In three patients out of the total 14, no infections had been found at admission, nor during the period that they stayed in private rooms. Eleven patients had positive cultures when transferred to single-patient rooms. Then, on their follow-up, they became culture negative.*

***Conclusion**: Single-patient rooms in the palliative care unit seem to be an effective method to control nosocomial infections.*

***Key words**: Injury, single-patient rooms, nosocomial infections, intensive care unit, palliative care.*

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Introduction

Nosocomial infections have resulted in a growing concern in hospitals and the control of the their transmission has been a matter of debate. Nosocomial infections are developed at least 48 hours after hospitalization and avoidable by procedures such as washing hands, and the cleanliness of equipment and the environment[1]. Nosocomial infections, which are often determined by resistant bacteria, happen in about 20-30% of patients in intensive care units (ICUs)[2]. They are related with considerable morbidity, mortality and increased length of stay (LOS)[3-6]. The main risk factor for nosocomial infection is previous colonization[7]. The isolation of patients via single-patient rooms is preferred for prevention of the spread of infectious organisms, by health care staff[7]. Developed hospital architecture potency may prevent the spread of microorganisms.

Many institutions recommend single-patient rooms, which provide improved infection control and enhanced isolation of patients from infectious agents[9,10].

Without concomitant diseases in young people, a severe trauma can cause patients to stay in ICUs for a long time with organ dysfunction and protein catabolism. Thus causing development of persistent inflammation, immunosuppression, and catabolic syndrome (PICS)[11]. They have immunosuppression, and are hence prone to secondary nosocomial infection and find it difficult to recover self-sufficiency. These patients, when discharged from the intensive care units, require more care and they stay in palliative care centres for rehabilitation. In these patients, upon arrival to palliative care ward, may be detect nosocomial infections acquired from ICU. We aimed to investigate whether private rooms in palliative care are effective or not in controlling infections.

Materials and methods

We retrospectively examined detailed microbiologic data of patients who stayed at the palliative care ward, which included a total of eleven private rooms, in Ulus State Hospital, Ankara, Turkey, between December 2012 and November 2013. Inclusion criteria were: adult trauma patients involved in motor vehicle collisions; those who had severe brain injury; those on mechanical ventilator support during long-term stays in intensive care unit (>25 days), and thereafter, admitted to the palliative care ward; those who were vegetative; those who had permanent tracheostomy and percutaneous endoscopic gastrostomy tube and those having a total lymphocyte count of < 800/mm3, serum albumin concentrations < 3.0 g/dl, creatinine height index < 80%, and weight loss > 10% or BMI < 18[11]. Patients having concomitant diseases, such as cancer or diabetes mellitus, and an age of <18 or >65 were excluded from the study. All patients were treated with standard infection control precautions. Each private room had its own sink, alcohol-based hand rub dispenser and medical supplies such as patient monitor, oxygen and equipment.

The nurse to patient ratio was 1:2 in each room. Immediately after palliative care rooms (PCRs) admission, for microbiological analysis, all patients' blood, tracheal aspirate, decubitus ulcer and urine specimens were obtained and, this procedure was repeated one week later. All health care workers and families of patients were required to follow hand hygiene practice. Thorough surface disinfection was provided in the PCR environment. In addition to these, all PCR patients had antibiotic therapies based on susceptibility testing.

Results

In the Palliative Care Ward of Ulus State Hospital, a total of 292 patients stayed between December 2012 and November 2013. Among 292 patients, 14 patients met inclusion criteria, 8 male and 6 female (age 18-63 years, mean ±SD 39.57 ±14.80 years). Three patients out of the total of 14 patients had no infections found upon admission to the Palliative Care Ward and over the period that they stayed in the PCRs. Eleven patients had positive cultures when transferred to PCRs (Table 1). One week later, these eleven patients became culture negative in the follow-up.

Discussion

In the present study, we demonstrated that three patients out of the total of 14 patients had no infections found at admission nor during their stays in the PCRs. Eleven patients had positive cultures when transferred to PCRs. Then, in their follow-up, they became culture negative. These outcomes may be due to our measures of single room isolation, enforcement of hand hygiene practice, providing surface disinfection and antibiotic therapy based on susceptibility testing.

The association between colonization and future infection is well demonstrated for many bacteria, and the colonization rate is therefore clinically important[12]. Bacteria may be acquired from exogenous sources, such as the physical environment, other patients, or health care workers. In addition, acquisition can be from an endogenous source, such as the patient's flora. Infection control efforts such as patient isolation are directed toward preventing the transmission of exogenous bacteria. A comparison of an intervention's effect on likely exogenous vs. likely endogenous colonization rates gives direct evidence of an intervention's success in achieving reduced exposure of patients to hospital-borne organisms[13].

About 20% of ICU patients will develop nosocomial infections. Bacteria are transmitted between ICU patients by direct contact (principally via caregivers' hands), droplets (for example, from infected airway secretions) and via fomites[13, 14]. Fomite is any object or substance capable of carrying infectious organisms, such as germs or parasites, and hence transferring them from one individual to another. Fomites are associated particularly with hospital-acquired infections (HAI), as they are possible routes to pass pathogens between patients. Stethoscopes and neckties are two such fomites associated with health care providers. Basic hospital equipment, such as IV drip tubes, catheters, and life support equipment can also be carriers, when the pathogens form biofilm on the surfaces. We can prevent cross-infection by careful sterilization of such objects. In our ICUs, the Institutional Infection Control Committee carries out a surveillance program. The Committee gives advices to prevent nosocomial infections.

Improved ICU architecture, including a change to single rooms, led to a statistically and clinically significant 72% decrease in the risk of acquiring resistant bacteria and a decrease in antibiotic usage.

1	Blood: Negative Tracheal aspirate: Negative Decubitus wound: Negative Urine: Negative
2	Blood: Escherichia coli Tracheal aspirate: Negative Decubitus wound: Acinetobacter baumannii Urine: Negative
3	Blood: Candida albicans, Methicillin-sensitive coagulase-negative staphylococcus Tracheal aspirate: Negative Decubitus wound: Acinetobacter baumannii Urine: Negative
4	Blood: Non-albicans candida, Methicillin-sensitive coagulase-negative staphylococcus Tracheal aspirate: Acinetobacter baumannii Decubitus wound: Proteus mirabilis Urine: Extended-spectrum beta-lactamase positive Escherichia coli
5	Blood: Negative Tracheal aspirate: Negative Decubitus wound: Negative Urine: Negative
6	Blood: Negative Tracheal aspirate: Negative Decubitus wound: Negative Urine: Pseudomonas aeruginosa
7	Blood: Negative Tracheal aspirate: Escherichia coli Decubitus wound: Negative Urine: Escherichia coli
8	Blood: Methicillin-resistant coagulase-negative staphylococcus Tracheal aspirate: Acinetobacter baumannii Decubitus wound: Negative Urine: Escherichia coli
9	Blood: Negative Tracheal aspirate: Negative Decubitus wound: Pseudomonas aeruginosa Urine: Escherichia coli
10	Blood: Negative Tracheal aspirate: Negative Decubitus wound: Negative Urine: Negative
11	Blood: Negative Tracheal aspirate: Negative Decubitus wound: Negative Urine: Extended-spectrum beta-lactamase positive Escherichia coli
12	Blood: Methicillin-resistant coagulase-negative staphylococcus Tracheal aspirate: Methicillin-resistant coagulase-negative staphylococcus Decubitus wound: Acinetobacter baumannii, Proteus mirabilis Urine: Extended-spectrum beta-lactamase positive Escherichia coli
13	Blood: Acinetobacter baumannii Tracheal aspirate: Pseudomonas aeruginosa Decubitus wound: Pseudomonas aeruginosa Urine: Extended-spectrum beta-lactamase positive Escherichia coli
14	Blood: Candida albicans Tracheal aspirate: Negative Decubitus wound: Negative Urine: Negative

Table 1: Spectra of bacterial colonization on admission of patients to palliative care wards.

Single rooms facilitate more frequent hand washing by health care workers and are easier to clean[3, 12], isolating patients with MRSA in private ICU rooms or cohorts, as recommended by various infection control guidelines[9]. Placement in private rooms simplifies adherence to infection control guidelines by concentrating all activities on the one patient room and avoids accidental re-use of contaminated medical devices for more than one patient.

Some authors, however, see this measure as requisite only for patients who could possibly contaminate the environment or do not maintain appropriate personal hygiene[13]. They think that placing a patient in a private room renders frequent visits by nurses, physicians, and other healthcare personnel less convenient, making it more difficult for staff to guarantee prompt and frequent care. Furthermore, they say it may be psychologically harmful, especially to children, and may also lead to increased expense[15]. The specific measures to be applied should be discussed individually in each case so as to elicit high compliance with infection control guidelines on the part of healthcare personnel and to avoid harming the patients. Most of the studies reporting a decrease in MRSA rates from placing patients in private rooms have also used other infection control measures such as active surveillance cultures and barrier precautions and sometimes decolonization procedures.

During one outbreak, the MRSA spread to other patients was 15.6-fold lower when colonized patients had already been recognized through active surveillance and placed in contact isolation (at the time involving the use of gowns, gloves, and masks) than with standard precautions (i.e. routinely relying on the use of gloves for touching secretions, excretions, or drainage, and hand washing between all patient contacts)[16]. The fact that index patients were managed in single rooms with the doors closed served as an important reminder to the attending healthcare workers to perform all necessary infection control practices, including hand hygiene according to the five moments recommended by WHO[17]. Designing for infection control - by separating patients, adding isolation facilities, adding hand hygiene stations, upgrading mechanical ventilation and filtration, revising provisions for disposal of human waste, or introduction of antimicrobial materials - can lower infection rates and therefore morbidity and mortality, cost per case, and length of stay[18]. Hand hygiene and antibiotic management diminish transmission of resistant pathogens in hospitals[19, 20]. Several studies reported that improved cleaning and disinfecting achievement considerably reduces environmental contamination with a range of health care-related microorganisms[21, 22]. Environmental cleaning and disinfecting arrangements in hospitals contribute to reducing nosocomial infections[23, 24].

Eleven patients in the present study had already nosocomial infections when transferred to the palliative care ward. The patients who met the PICS crite-

ria, included our study, might have acquired the nosocomial infections from ICUs. PICS patients are characterized with prolonged stay time in the ICU, weight loss > 10% or BMI < 18 and specific laboratory parameters such as a total lymphocyte count of < 800/mm3, serum albumin concentrations < 3.0 gm/dl and creatinine height index < 80%. They had immunosuppression associated with critical illness and physiological defects[11]. In patients having sepsis, both bacterial clearance and releasing pro-inflammatory cytokines decrease, therefore they are prone to secondary infections[25, 26]. When they come out of the ICU is still infected and susceptible to other infection. For such patients, measures of infection prevention are very important.

Conclusions

Private rooms enable isolation of PICS patients. Antibiotic therapies based on susceptibility testing, infection control practices such as enforcement of hand hygiene practice, constitution of the environmental cleaning and disinfecting arrangements eliminate the colonization of microorganisms.

References

1) *The Surgical Infection Society. Consensus paper on the surveillance of surgical wound infections. The Society for Hospital Epidemiology of America; The Association for Practitioners in Infection Control*; The Centers for *Disease Control*. Infect Control Hosp Epidemiol. 1992; 13(10): *599-605*.
2) Saloojee H, Steenhoff A. *The health professional's role in preventing nosocomial infections*. Postgrad Med J. 2001; 77(903): *16-19*.
3) Bracco D, Dubois MJ, Bouali R, Eggimann P: *Single rooms may help to prevent nosocomial bloodstream infection and cross-transmission of methicillin-resistant Staphylococcus aureus in intensive care units*. Intensive Care Med. 2007; 33(5): *836-840*.
4) Huang SS, Yokoe DS, Hinrichsen VL, Spurchise LS, Datta R, Miroshnik I, Platt R. *Impact of routine intensive care unit surveillance cultures and resultant barrier precautions on hospital-wide methicillin-resistant Staphylococcus aureus bacteremia*. Clin Infect Dis. 2006; 43(8): *971-918*.
5) Heyland DK, Cook DJ, Marshall J, Heule M, Guslits B, Lang J, Jaeschke R. *The clinical utility of invasive diagnostic techniques in the setting of ventilator-associated pneumonia*. Chest. 1999; 115(4): *1076-1084*.
6) Inan D, Saba R, Yalcin AN, Yilmaz M, Ongut G, Ramazanoglu A, Mamikoglu L. *Device-associated nosocomial infection rates in Turkish medical-surgical intensive care units*. Infect Control Hosp Epidemiol. 2006; 27(4): *343-348*.
7) Bonten MJ, Weinstein RA. *The role of colonization in the pathogenesis of nosocomial infections*. Infect Control Hosp Epidemiol. 1996; 17(3): *193-200*.
8) Gastmeier P, Schwab F, Geffers C, Rüden H. *To isolate or not to isolate? Analysis of data from the German Nosocomial Infection Surveillance System regarding the placement of patients with methicillin-resistant Staphylococcus aureus in private rooms in intensive care units*. Infect Control Hosp Epidemiol. 2004; 25(2): *109-113*.
9) *American Institute of Architects. Guidelines for Design and Construction of Hospital and Health Care Facilities*. Washington, DC: American Institute of Architects. 2001. Available at http://www.fgiguidelines.org/pdfs/2001guidelines.pdf
10) Detsky ME, Etchells E. *Single-patient rooms for safe patient-centered hospitals*. JAMA. 2008; 300(8): *954-956*.
11) Gentile LF, Cuenca AG, Efron PA, Ang D, Bihorac A, McKinley BA, Moldawer LL, Moore FA. *Persistent inflammation and immunosuppression: a common syndrome and new horizon for surgical intensive care*. J Trauma Acute Care Surg. 2012 Jun; 72(6): *1491-501*.
12) Merrer J, Santoli F, Appéré de Vecchi C, Tran B, De Jonghe B, Outin H. "*Colonization pressure" and risk of acquisition of methicillin-resistant Staphylococcus aureus in a medical intensive care unit*. Infect Control Hosp Epidemiol. 2000; 21(11): *718-723*.
13) Edmond M. Isolation. Infect Control Hosp Epidemiol. 1997; 18(1): 58-64.
14) Haley RW, Cushion NB, Tenover FC, Bannerman TL, Dryer D, Ross J, Sánchez PJ, Siegel JD. *Eradication of endemic methicillin-resistant Staphylococcus aureus infections from a neonatal intensive care unit*. J Infect Dis. 1995; 171(3): *614-624*.
15) Jernigan JA, Titus MG, Gröschel DH, Getchell-White S, Farr BM. *Effectiveness of contact isolation during a hospital outbreak of methicillin-resistant Staphylococcus aureus*. Am J Epidemiol. 1996; 143(5): *496-504*.
16) Multimodal Hand Hygiene Improvement Strategy Available at http: // www. who.int/ gpsc/5may/Guide_ to_Implementation.pdf
17) Thompson DR, Hamilton DK, Cadenhead CD, Swoboda SM, Schwindel SM, Anderson DC, Schmitz EV, St Andre AC, Axon DC, Harrell JW, Harvey MA, Howard A, Kaufman DC, Petersen C. G*uidelines for intensive care unit design*. Crit Care Med. 2012; 40(5): *1586-1600*.
18) Weinstein RA. *Controlling antimicrobial resistance in hospitals: Infection control and use of antibiotics*. Emerg Infect Dis. 2001; 7(2): *188-192*.
19) Gerberding JL. *Hospital-onset infections: a patient safety issue*. Ann Intern Med. 2002; 137(8): *665-670*.
20) Smith TL, Iwen PC, Olson SB, Rupp ME. *Environmental contamination with vancomycin-resistant enterococci in an outpatient setting*. Infect Control Hosp Epidemiol. 1998; 19(7): *515-518*.
21) Linkin DR, Fishman NO, Patel JB, Merrill JD, Lautenbach E. *Risk factors for extended-spectrum beta-lactamase-producing enterobacteriaceae in a neonatal*

*intensive are uni*t. Infect Control Hosp Epidemiol 2004; 25(9): *781-783*.

22) Kaatz GW, Gitlin SD, Schaberg DR, Wilson KH, Kauffman CA, Seo SM, Fekety R. *Acquisition of Clostridium difficile from the hospital environment*. Am J Epidemiol. 1988; 127(6): *1289-1294*.

23) Apisarnthanarak A, Zack JE, Mayfield JL, Freeman J, Dunne WM, Little JR, Mundy LM, Fraser VJ. *Effectiveness of environmental and infection control programs to reduce transmission of Clostridium difficile*. Clin Infect Dis. 2004; 39(4): *601-602*.

24) Munoz C, Carlet J, Fitting C, Misset B, Bleriot JP, Cavaillon JM. *Dysregulation of in vitro cytokine production by monocytes during sepsis*. J Clin Invest. 1991; 88(5): *1747-1754*.

25) Ayala A, Chaudry IH. *Immune dysfunction in murine polymicrobial sepsis: mediators,macrophages, lymphocytes and apoptosis*. Shock. 1996; Suppl 1: *27-38*.

26) Bone RC, Grodzin CJ, Balk RA. *Sepsis: a new hypothesis for pathogenesis of the disease process*. Chest. 1997; 112(1): *235-243*.

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