Original Article

Relationship Between Blood Transfusion and Risk of Nosocomial infection in Intensive Care Unit Patients

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Abstract

Objective: To investigate association between nosocomial infection, blood products transfusion and microorganisms responsible in patients who hospitalized at ICU (intensive care unit).

Patients and Methods: In this prospective study, 217 patients who were admitted to the ICU of Taleghani Hospital between August 2010 and August 2011 were included. Nosocomial infections were defined using the contacts for disease control and development national nosocomial infections surveillance definitions. Overall, site specific nosocomial infections rates, blood units received, attributable mortality rate and excess length of hospital stay and other variable were considered.

Results: The overall nosocomial infection rate was 24.9% (54 patients). The most common type of nosocomial infection was respiratory tract infections (6.5%, 14) with an attributable mortality rate of 3.7%. In patients who received blood products, 26.6% (37) acquired nosocomial infections. Despite the high percentage of blood transfusion in the hospital, no statistically significant relationship was observed between nosocomial infections and blood product transfusion.

Conclusion: No significance relation was found between NIs and blood transfusion**,** but was observed between FFP transfusion and NIs. It's emphasized the need for careful disinfection for FFP transfusion in ears that serve immunosuppressed individual, such as pediatric patients.

Keywords: Nosocomial Infections; blood transfusion; intensive care unit

Introduction

Many experimental studies and randomized trials have examined various methods to prevent nosocomial infections (1-3). The highest rates of nosocomial infections are observed in intensive care units (ICUs), where the most severely ill patients are treated and the highest mortality rates are observed (4-7).

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Over the past several decades a body of evidence has accumulated that indicates various adverse effects in patients who receive transfusions, particularly with exposure to allogeneic blood (that is, blood received from a genetically dissimilar individual). Effects include, but are not limited to, postoperative pneumonia, sepsis, and mortality (8-12).

Variation in the use of blood components is substantial. Recent studies have implicated prolonged storage of blood products as an important factor, although investigations of patients' responses to specific stored blood components are ongoing (1, 13, 14). Rogers et al. showed that allogeneic blood transfusion was associated with an increased risk of infection at multiple sites, suggesting a system-wide immune response. Hospital variation in transfusion practices after coronary artery bypass grafting was considerable, indicating that quality efforts may be able to influence practice and improve outcomes (1, 15-17). Although multiple factors may explain the association between blood administration and decreased survival, transfusion-related nosocomial infection is likely to be an important contributor to morbidity and mortality. Basic mechanisms underlying transfusion-related immune modulation may include soluble white blood cell- derived biological modifiers in allogeneic

RBC transfusions that alter effector or suppressor T lymphocyte activity, suppression of natural killer cell function (2, 4), defective antigen presentation, or inhibition of lymphocyte proliferation in response to antigenic stimulus (8, 9, 18).
We designed a semi-prospective study to evaluate whether blood transfusion can increase the risk of nosocomial infections in patients who hospitalized in ICU or not.

Patients and Methods

In this work, we studied patients who aged > 15 years old and were admitted to the ICU due to various diseases, including cancer, trauma, CRF and etc., during 12 months period from August 2010 to August 2011 (217 subjects). Nosocomial infection cases, received units of blood and other risk factors were detected.
Risk factors included age, gender, mean length of hospital stay, mean admission days, surgery, and transfer from other hospital, invasive device usage, prior broad spectrum antibiotic usage, and blood transfusion which can increase nosocomial infections. Relationship between nosocomial infections and risk factors was determined using the Chi square test and univariate analysis, ANOVA and t-test.
All significant variable and risk factors were then entered into a multivariate model. An explanatory model was opted, backward conditional was used as the selection method, and a relatively high significance level (P<0. 05) was applied for each variable retained in the model. Statistical analyses were performed using the SPSS software for Windows.

Results

Of the 217 subjects enrolled, 139 (64.1%) received blood transfusions which in this group 26.6% acquired nosocomial infections. Despite receiving high rates of blood transfusion among patients, statistically significant relationship between hospital infections and blood transfusion was not observed (P= 0.268). Also crosstab analysis detected the same results between any types of nosocomial infection and blood transfusion (P= 0.673) (**Table 2**). By applying this statistical method, significant relationships were observed between washed blood cells and getting nosocomial infections (P= <0.001), blood transfusion and mortality rate (P= 0.006), FFP transfusion and enterobacteriaceae family (P= 0. 05), enterobacteriaceae family and types of any nosocomial infection (P = 0.0), hospitalization day and blood transfusion (P= 0.007), but no significance relationship was observed between blood transfusion and enterobacteriaceae family (p-value= 0.197) (**Table 3**).
On the other hand, infections caused by enterobacteriaceae were observed in patients with previous hospitalization in CCU and ICU, surgery, emergency, ENT and nephrology wards were 2.3%, 1.4%, 0.9%, 0.9% and 0.5% respectively with p-value=0.041. There was a significant correlation between enterobacteriaceae family and age group as in the age group of 45 to 75 years the highest rate of contamination with enterobacteriaceae infections (p-value= 0.03). Men were more likely to receive a transfusion than women (53.9% and 46.1% respectively) (**Table 4**).
One of the interesting points in the study was statistically significant correlation between previous ward admission and the need for blood transfusion (0.013), so patients who had been hospitalized at gastroenterology ward before ICU hospitalization were more prone to receive blood transfusion compared to other patients. Likewise, a significant correlation (P= 0.041) was observed between previous ward admission and infection by enterobacteriaceae family.

The overall nosocomial infections rate was 24.9% (54 patients). The most common type of nosocomial infection was respiratory tract infections (6.5%) with an attributable mortality rate of 3.7%, followed by catheter–related bloodstream infection (5.5%) with an attributable mortality rate of 3.2%, miscellaneous infections (3.7%) with an attributable mortality rate of 0.9%, ventilator associated pneumonia (3.2%) with an attributable mortality rate of 1.4%, catheter associated urinary tract infection (2.3%) with an attributable mortality rate of 1.4%, more than one infection (2.3%) with an attributable mortality of 1.4% and surgical site infection (1.4%) with an attributable mortality rate of 0.5%. Excess extra day of hospital stay (The mean of hospitalization days of patients with NIs and without NIs) was 5.58 days (p-value= <0.001), totally hospitalization day in patients with more than one infection was highest with 18.6 days (**Table 1**).

Table1. Comparison of risk factors studied between patients who developed nosocomial infections and those who did not.

Risk factors	Patients with NIs	Patients without NIs	p-value
Number of patients	54 (24.9%)	163(75.1%)	-
Patients-days	10.35	4.77	<0.001
Mean age	61.85	52.72	0.005
Male, %	29	88	0.547
Female, %	25	75	
Antibiotic	50	136	0.069
Upper GI endoscopy	9	21	0.312
Colonoscopy	5	5	0.072
Biopsy	2	4	0.465
Mean GCS average	11.24	12.41	0.003

GCS= Glasgow Coma Scale; GI= gastrointestinal; NI= nosocomial infection

Table2. Comparison of blood transfusion type and units transfused between patients who developed nosocomial infections and those who did not.

	Patients with NIs	Patients without NIs	p-value
Blood transfusion units	37	102	0.268
Washed blood cells	7	1	<0.001
FFP	24	63	0.243
Cro	2	2	0.259
Platelet	9	16	0.132
PC	35	96	0.272

FFP= fresh frozen plasma; Cro= Cryoprecipitate ; PC= packed cells; NI= nosocomial infection

Table3. Comparison of infectious agents found in patients who received blood transfusion and those who did not.

Characteristics	With blood transfusion	Without blood transfusion	p-value
Enterobacteriaceae family	7	7	0.197
Gram negative	13	9	0.383
Gram positive	22	6	
Both gram negative & gram positive	2	1	

Table 4. Relation between Blood transfusion, attributable mortality, hospitalization and gender

Cha Characteristics	With blood transfusion	Without blood transfusion	p-value
Mortality rate	76.81%	23.18%	0.006
Mean hospitalization duration, day	8.56	5.42	0.007
Male	51.1%	59%	0.164
Female	48.9%	41%	

Discussion

This analysis of prospective observational study of critically ill patients reveals that blood transfusion is independently associated with nosocomial infection in ICU. This relationship is independent with a number of confounders including gender, biopsy, colonoscopy, previous ward admission, antibiotic [patients with antibiotic usage or no]. Findings by Taylor et al. showed relationship between packed red blood cell and nosocomial infections (19). Murphy et al. (20) showed relationship between red blood cell administration and nosocomial infections. Previous studies have also noted relationship between packed red blood cell usage and blood stream infections (21, 22). These differences may be related to various wards where studies have been done, treatment and races of studied population in the study. Additionally, we detected a correlation between blood transfusion and infectious microorganisms. This suggests blood transfusion may facilitate infection with gram positive bacteria. Although prior investigations have documented a link between blood products transfusion and nosocomial infection, few reports focused on special nosocomial infection. In this study we detected no statistical correlation between nosocomial infections, hospitalization, Glasgow coma score and enterobacteriaceae infectious microorganisms. We detected that patients hospitalized in gastroenterology ward were more prone to receive blood products.

Conclusion

No significant relationship was found between nosocomial infections and receiving blood transfusion, except FFP. However, it is recommended that specific guidelines to be considered in patients who received blood products to prevent nosocomial infections in critically ill patients especially FFP blood transfusion.

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