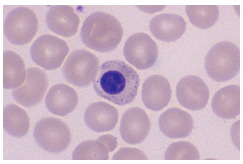
GOOD SAMARITAN HOSPITAL ICU NEWSLETTER

The *Critical Point*

A Quarterly Publication

Issue 1 July 2005



DONATE LIFE
A Donate Life Organization

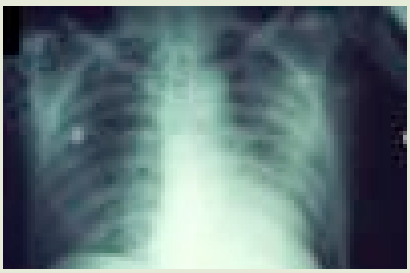
WELCOME TO

The *Critical Point*

Welcome to the inaugural edition of *The Critical Point*. In what is intended to be a quarterly publication, topics involving the care of the critically ill patient will be presented. Among the featured segments will be evidence based guidelines for patient care, a profile of pharmacologic agents typically used in the ICU setting, a review of interesting and thought provoking articles recently published, QI statistics and initiatives, house staff research projects underway and more. *The Critical Point* will be published in .pdf format and distributed by e-mail to allow readers to open via Adobe Acrobat Reader .

While this initially is a work in progress, the success and viability of any publication is dependent on the input from its readers and comments are welcome. Many critical care topics are controversial and a diversity of opinion adds to the interest. Contributions are appreciated.

E-mail comments and suggestions to:
christopher_hayner@cgha.com



Taking steps to minimize risk factors linked to ventilator-associated pneumonia could have significant impact on mortality and medical care costs

VAP continues to be major QI focus

Hospital acquired pneumonia (HAP) continues to account for significant morbidity, mortality, and cost in the critical care setting. Among intubated and mechanically ventilated patients, a ventilator-associated pneumonia (VAP) is defined as any pneumonia that starts >48 hrs after initiation of mechanical ventilation. Based on data from >14,000 ICU patients in the U.S. National Nosocomial Infection Surveillance System, HAP remains the second commonest nosocomial infection after urinary tract infection, affecting 27% of all critically ill patients. "Attributable mortality" in patients with HAP/VAP may account for up to 50% of all mortality and excess medical costs per case have been estimated to range from $5,800 to $20,000. Various reported risk factors for HAP/VAP have included the following:

- Witnessed aspiration
- Chronic obstructive pulmonary disease
- Administration of antacids/ H2 antagonists
- Supine positioning
- Coma
- Enteral nutrition
- Nasogastric tube
- Reintubation
- Tracheostomy
- Patient transport
- Acute respiratory distress syndrome
- Prior antibiotic exposure
- Age > 60 years
- Head trauma
- Presence of intracranial pressure monitoring

(continued on page 3)

GSH OFFERS PALLIATIVE CARE PROGRAM

Palliative care is medical care which specializes in effectively treating the pain, symptoms and stress that can accompany serious illness. It is designed to support any other treatments patients may receive by helping them live comfortably throughout their illness. The goal of palliative care is to relieve symptoms and maintain the best quality of life for patients and their families while they are fighting disease. An interdisciplinary team approach is used in order to address not only physical but also psychological, social, cultural, emotional and spiritual needs of the patient and family.

The team is available to work alongside the attending physician and unit staff to incorporate palliative care principles into the treatment plan. Examples might include: 1) assistance in the medical management of pain, nausea, dyspnea and fatigue 2) clarifying medical information for patients and families including burdens and benefits of treatments 3) identifying goals of treatment desired by the patient and family, both immediate and upon discharge and 4) support while patents and families tackle difficult decisions such as code status and advanced care planning.

Palliative care is often misunderstood or mistaken for solely end-of -life care but can be used at any stage of illness. Unlike hospice care, palliative care is available at anytime during an illness, can allow patients to continue to receive life sustaining treatments and is covered under traditional insurance plans.

Palliative care consults can be considered for repeated admissions for advanced chronic illnesses, symptoms interfering with quality of life, significant progressive functional decline, spiritual or emotional distress, when curative therapies are showing a lack of response or conflicts exist among patients and family members regarding illness management or treatment course.

The program is under the direction of Dr. Manish Srivastava and Sandi Webb, RN is the nurse clinician. The team is available for consults Monday through Friday (8am-5pm) and can be reached at 872-2864.

Lowering the bar for RBC transfusions

Ten and thirty. These have been the values taught to medical students for years as the goal for hemoglobin and hematocrit levels respectively. Evidence has accumulated that such a mantra has deleterious consequences.

Anemia is a frequent finding in the ICU. While many patients present with anemia (GI hemorrhage, trauma, surgery, chemotherapy), other factors lead to or exacerbate pre-existent anemia. Through phlebotomy alone, it is estimated ICU patients lose nearly 60 mL blood per day. An "anemia of critical illness" also exists. While one would expect an inverse relationship between hematocrit and erythropoietin (EPO) levels, this frequently does not exist in critically ill patients. Pro-inflammatory cytokines suppress transcription of key sensors of tissue hypoxemia, limit endogenous production of EPO, alter iron metabolism and decrease RBC production in the bone marrow. Reticulocytosis is also significantly limited and RBC survival is reduced. Within 48 hrs of ICU admission, almost 70% of patients have hgb values <12 g/dL and half have levels < 10 g/dL. In previous observational studies, as many as 40% of this cohort receive transfusions.

In 1942, an article appeared in the literature entitled "Anesthesia in cases of poor risk: Some suggestions for decreasing the risk. " (*Surg Gynecol Obstet* 1942;74: 1011-1101) where the 10/30 rule may have been first proposed. It seems to have become more a matter of faith than data. In 1999, the landmark Transfusion Requirements in Critical Care (TRICC) study was published by Herbert, et al but seemingly has gone largely unadopted in clinical practice. TRICC compared a strategy of transfusing for hgb < 7 (the restrictive strategy) vs transfusing for hgb < 10 (the liberal strategy). This multi-center, randomized, controlled clinical trial enrolled over 800 patients with the following results:

Overall, 30-day mortality was similar in the two groups (18.7 percent vs. 23.3 percent, P= 0.11). However, the rates were significantly lower with the restrictive transfusion strategy among patients who were less acutely ill - those with an Acute Physiology and Chronic Health Evaluation II score of <20 (8.7 percent in the restrictive-strategy group and 16.1 percent in the liberal-strategy group, P=0.03) -and among patients who were less than 55 years of age (5.7 percent and 13.0 percent, respectively; P=0.02), but not among patients with clinically significant cardiac disease (20.5 percent and 22.9 percent, respectively; P=0.69). The mortality rate during hospitalization was significantly lower in the restrictive-strategy group (22.2 percent vs. 28.1 percent, P=0.05). It should be stressed that this study enrolled only hemodynamically stable patients and cannot be applied to those with acute hemorrhage, as part of a resuscitation from shock strategy, or in cardiac surgery patients

In 2002, a European observational study noted that, in those with a hgb < 10 g/dL, the 40% who received transfusions had a mean pre-transfusion hgb of 8.4 g/dL. The commonest reason recorded for the transfusion was "low hemoglobin." The CRIT Study published in 2004 was a large multi-center observational study investigating transfusion practices in the ICU in the U.S. The findings were similar to those recorded above and demonstrated that, in spite of TRICC, transfusion practice had changed very little over time.

A CRIT subgroup analysis focusing on mechanical ventilation (MV) patients was published by Levy, et al. They found that >75% of all transfused blood was delivered to ventilated patients. Similar to the European data, the most common reason recorded for transfusion was not active bleeding or hemodynamic instability but "low hemoglobin." Again, the mean hgb value was 8.4 g/dL. Moreover, 40% of the transfusions occurred after day 4 of the ICU stay, not necessarily in the more acute phase of the patients illness. (continued on page 3)

Transfusions (from page 1)

While not expressly designed for this purpose, in a separate analysis higher hgb levels did not result in shorter duration of MV. If the TRICC findings are accepted and there is no advantage to a liberal transfusion strategy, are there significant risks?

Many studies haves shown that routine transfusions are associated with increased morbidity, mortality and length of stay. Transfused patients had more complications including fever, volume overload, sepsis, thromboembolism, and ARDS. The incidence of bacteremia is directly proportional to the number of units transfused (Shorr). There is a significant association between number of RBC transfusions and risk of subsequent infection in patients after trauma, burns, and a variety of surgical procedures, both elective and emergency. Postoperative complications occur in a dose-dependent manner in surgical patients independent of the procedure. Often used to increase systemic oxygen delivery, the effectiveness of this has been questioned. Complete depletion of 2,3-dpg concentrations occur after two weeks of storage thereby reducing the ability of transfused blood to offload 02 by over 50%. RBC ATP levels decrease following storage reducing the cellular deformity of the erythrocyte which may impact perfusion and contribute to capillary sludging and organ dysfunction.

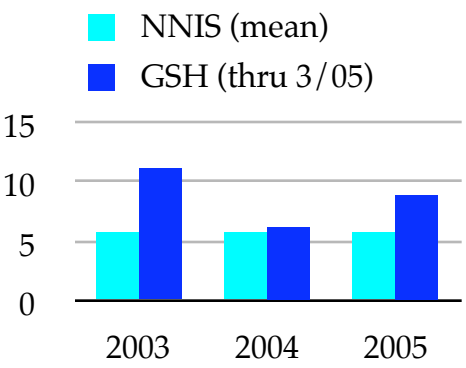
Soluble bioactive substances are also present in stored blood including histamine, HLA Class I and II antigens and proinflammatory cytokines (IL-1, IL-6, IL-8 and TNF-α). Transfusion related acute lung injury is an underecognized event resulting from passive transfer of antibodies to the recipient causing pulmonary sequestration, complement activation and lung injury. Arginase released from stored blood may degrade arginine which is a potent stimulant of lymphocyte function and may also be a mediator of immunosuppression. Allogenic blood transfusions decrease the helper/suppressor T-cell ratios, natural killer cell function and defective antigen presentation.

A substantial body of literature suggests that exposure to allogenic leukocytes may trigger an immune response in the recipient leading to increased risk of infection, earlier recurrence of malignancy, and increased mortality. Recent studies evaluating outcomes after the institution of a universal leuko-reduction program have been conflicting. It is also unclear as to what, if any, clinical significance the "age" of stored blood may have.

While further studies are needed to elaborate the risks of anemia, the optimal hemoglobin level and the transfusion risks, the dilemma may be better focused not be fresh vs old blood or leukocyte-depleted vs non-depleted blood but between stored blood vs no blood. Empirical automatic transfusion thresholds may need to be abandoned in favor of a practice of RBC transfusion only for a defined physiologic need.

Ventilator-Associated Pneumonia (from page 1)

Efforts to lower the VAP incidence (see graph below) are being conducted on several fronts. Mouth care protocols were instituted to facilitate improved oral hygiene. Respiratory therapists are assessing "readiness to wean" criteria on appropriate patients to more quickly identify patients ready for extubation after completing spontaneous breathing trials. BiPAP noninvasive ventilation protocols are being devised and may be particularly suitable for COPD exacerbations and pulmonary edema in reducing the number of ventilated patients. Nasotracheal intubations are discouraged and should be converted as early as possible. Similarly, orogastric tubes also decrease the occurrence of sinusitis and the subsequent aspiration of infected secretions. Maintaining the head of bed at least 30 degrees is also of value. Semi-recumbent patient positioning results in a three-fold reduction in the incidence of VAP and is of greater importance in patients given enteral nutrition. The appropriate use and limitation of antibiotics may also be of benefit in reducing VAP rates. A large randomized trial showed an 8 day antibiotic course was associated with a decrease in the emergence of resistant bacteria and maintained a similar efficacy as a 15 day course. Use of "prophylactic" antibiotics may reduce VAP in certain high risk patients but should be time-limited. RBC transfusions (see accompanying article) are also an independent risk factor for VAP. Hand washing and disinfection lowers the transmission of microorganisms to patients via health care personnel's hands. Efforts to minimize and consolidate patient transports from the ICU also play a role in such a strategy and will require communication between services in complex patients. In conclusion, a multifaceted approach allows many opportunities to target and reduce risks of hospital and ventilator associated pneumonia.



LifeCenter ORGAN DONOR NETWORK

Good Samaritan Hospital and LifeCenter Organ Donor Network have joined in an initiative by participating in a national collaborative with a goal of increasing organ donation. The purpose is the following: "Committed to saving or enhancing thousands of lives a year by spreading best known practices to the nations largest hospitals to achieve organ donation rates of 75% or higher in these hospitals."

GSH senior leaders include Dave Dornheggen and Mary Irvin. Janet Ginn, Marty House and Lisa Trapp serve as team leaders. Lindsay Peterson (558-0259) is the Hospital Development Liaison for the LifeCenter Organ Donor Network. The 3 step referral process is designed to be timely and efficient.

Step 1: A referral process is initiated within one hour of determining a patient is vent dependent with an irreversible brain injury AND is unresponsive on assessment AND exhibits abnormal flexion, extension or no movement to noxious stimuli. Alternatively, notification will be initiated before withdrawing ventilation or medical support.

Step 2: The nursing staff is to then call the LifeCenter. Discussions of organ donation or notification of LifeCenter is not undertaken with the family at this point.

Step 3: LifeCenter arrives on site to evaluate patient's donation option and verify existence of donor designation and guides families through the process.

Admission Cap Placed on ICU Medical R-1's

Based on ACGME rules which state that PGY1 residents must not admit more than 5 new patients and 2 in house transfers in a 24 hour period and no more than 8 new patients in a 48 hour period, a cap has been imposed on "covered" patients to the critical care units at Good Samaritan Hospital. While it is anticipated that this would not be a daily occurrence and would be infrequently needed, some guidelines have been established to facilitate this and continue to provide quality care to patients in the critical care setting.

- The resident team (either senior or on call intern) will notify the E.R. and the MICU/CCU charge nurses when the coverage limit has been reached.

- All subsequent admissions will require the admitting physician to provide the admitting/transfer orders. Preprinted ICU order sets have been developed to simplify and expedite this. These can be completed in conjunction with the E.R staff for those being admitted from that unit. For patients being transferred from the floor, it is more appropriate to complete the orders with the receiving nurse. Any orders which need to be emergently carried out while the patient is still on a general ward should continue to be instituted through the nursing staff providing care for the patient at that time especially in the event where delays may prevent prompt transfer to the critical care unit. Admitting physicians may, at their discretion, consult the hospitalist to assist in the assessment, transfer or management of the patient.

- In the event that the attending physician of record is not available for ward patients needing critical care, the nursing staff will notify the hospitalist/emergency house physician to assist in facilitating the transfer.

- NO DNR/Comfort Care patients will have resident coverage when admitted to the ICU

- An effort will be made to eliminate inappropriate placement of patients into the ICU. Admissions to the intensive care units will be monitored on a regular basis to assure compliance with specified and accepted criteria for appropriateness.

- With the cap limitations comes the responsibility of appropriately allocating residents to the most relevant cases. To achieve this, senior residents in the ICU will have the opportunity to screen patients for appropriateness for coverage and decline coverage on patients with little teaching value thus preserving cap room for the more pertinent cases.

- Residents will still cover all codes regardless of cap

- Residents will provide stickers for charts for all covered patients to facilitate easy identification.

- The ICU senior resident will cover any patient admitted to the ICU after a code blue and transfer the care of the patient to another intern the following day. If the ICU senior resident requires assistance, the floor senior and the hospitalist may function as back up.

- For patients transferred to a critical care unit without coverage, a request for coverage can be made at a later time and will count towards the accepting medical teams daily cap.

Upcoming Articles

The next issue will focus on the Surviving Sepsis Campaign and a review of guidelines for the management of sepsis and septic shock. Xigris (drotrecogin alfa) will be profiled and the GSH experience to date with this agent reviewed.

References and Further Reading

A multicenter, randomized, controlled clinical trial of transfusion requirements in critical care. Hébert PC, Wells G, Blajchman MA, et al. **N Engl J Med 1999;340:409-417.**

Background To determine whether a restrictive strategy of red-cell transfusion and a liberal strategy produced equivalent results in critically ill patients, we compared the rates of death from all causes at 30 days and the severity of organ dysfunction.

Methods We enrolled 838 critically ill patients with euvolemia after initial treatment who had hemoglobin concentrations of less than 9.0 g per deciliter within 72 hours after admission to the intensive care unit and randomly assigned 418 patients to a restrictive strategy of transfusion, in which red cells were transfused if the hemoglobin concentration dropped below 7.0 g per deciliter and hemoglobin concentrations were maintained at 7.0 to 9.0 g per deciliter, and 420 patients to a liberal strategy, in which transfusions were given when the hemoglobin concentration fell below 10.0 g per deciliter and hemoglobin concentrations were maintained at 10.0 to 12.0 g per deciliter.

Results Overall, 30-day mortality was similar in the two groups (18.7 percent vs. 23.3 percent, P= 0.11). However, the rates were significantly lower with the restrictive transfusion strategy among patients who were less acutely ill — those with an Acute Physiology and Chronic Health Evaluation II score of ≤20 (8.7 percent in the restrictive-strategy group and 16.1 percent in the liberal-strategy group, P=0.03) — and among patients who were less than 55 years of age (5.7 percent and 13.0 percent, respectively; P=0.02), but not among patients with clinically significant cardiac disease (20.5 percent and 22.9 percent, respectively; P=0.69). The mortality rate during hospitalization was significantly lower in the restrictive-strategy group (22.2 percent vs. 28.1 percent, P=0.05).

Conclusions A restrictive strategy of red-cell transfusion is at least as effective as and possibly superior to a liberal transfusion strategy in critically ill patients, with the possible exception of patients with acute myocardial infarction and unstable angina.

The CRIT Study: Anemia and blood transfusion in the critically ill-Current clinical practice in the United States *.

Critical Care Medicine. 32(1):39-52, January 2004.

Corwin, Howard L. MD; Gettinger, Andrew MD; Pearl, Ronald G. MD, PhD; Fink, Mitchell P. MD; Levy, Mitchell M. MD; Abraham, Edward MD; MacIntyre, Neil R. MD; Shabot, M. Michael MD; Duh, Mei-Sheng MPH, ScD; Shapiro, Marc J. MD

Abstract:

Objective: To quantify the incidence of anemia and red blood cell (RBC) transfusion practice in critically ill patients and to examine the relationship of anemia and RBC transfusion to clinical outcomes.

Design: Prospective, multiple center, observational cohort study of intensive care unit (ICU) patients in the United States. Enrollment period was from August 2000 to April 2001. Patients were enrolled within 48 hrs of ICU admission. Patient follow-up was for 30 days, hospital discharge, or death, whichever occurred first.

Setting: A total of 284 ICUs (medical, surgical, or medical-surgical) in 213 hospitals participated in the study.

Patients: A total of 4,892 patients were enrolled in the study.

Measurements and Main Results: The mean hemoglobin level at baseline was 11.0 +/- 2.4 g/dL. Hemoglobin level decreased throughout the duration of the study. Overall, 44% of patients received one or more RBC units while in the ICU (mean, 4.6 +/- 4.9 units). The mean pretransfusion hemoglobin was 8.6 +/- 1.7 g/dL. The mean time to first ICU transfusion was 2.3 +/- 3.7 days. More RBC transfusions were given in study week 1; however, in subsequent weeks, subjects received one to two RBC units per week while in the ICU. The number of RBC transfusions a patient received during the study was independently associated with longer ICU and hospital lengths of stay and an increase in mortality. Patients who received transfusions also had more total complications and were more likely to experience a complication. Baseline hemoglobin was related to the number of RBC transfusions, but it was not an independent predictor of length of stay or mortality. However, a nadir hemoglobin level of <9 g/dL was a predictor of increased mortality and length of stay.

Conclusions: Anemia is common in the critically ill and results in a large number of RBC transfusions. Transfusion practice has changed little during the past decade. The number of RBC units transfused is an independent predictor of worse clinical outcome.

A Descriptive Evaluation of Transfusion Practices in Patients Receiving Mechanical Ventilation*

Mitchell M. Levy, MD, FCCP; Edward Abraham, MD; Marya Zilberberg, MD, FCCP and Neil R. MacIntyre, MD, FCCP ***Chest.*** **2005;127:928-935**

Study objectives: To characterize and compare transfusion practices in a broad sample of patients receiving mechanical ventilation (MV) and not receiving MV in the ICU.

Design: Retrospective subgroup analysis from the prospective, multicenter, observational CRIT study.

Setting: Two hundred eighty-four medical, surgical, or medical/surgical ICUs.

Main results: Of the 4,892 patients enrolled in the CRIT study, 60% were receiving MV on ICU admission or within 48 h after admission for a median of 4 days. Patients receiving MV had higher baseline APACHE (acute physiology and chronic health evaluation) II scores than patients not receiving MV (22.8 ± 7.8 and 14.9 ± 6.4, respectively [mean ± SD]; $p < 0.0001$). Despite similar baseline hemoglobin levels (11.0 ± 2.3 g/dL and 10.9 ± 2.5 g/dL, $p = 0.17$), more patients receiving MV underwent transfusions (49% vs 33%, $p < 0.0001$), and they received significantly more RBCs than patients not receiving MV ($p < 0.0001$). The principal reason for transfusion in both groups was low hemoglobin level (78.4% and 84.6%, respectively); however, patients receiving MV had higher pretransfusion hemoglobin levels (8.7 ± 1.7 g/dL) than patients not receiving MV (8.2 ± 1.7 g/dL, $p < 0.0001$). Notably, 40.1% of all transfusions in patients receiving MV were administered after day 3 of the ICU stay, compared to 21.2% in patients

not receiving MV ($p < 0.0001$), and a higher percentage of patients receiving MV remaining in the ICU after day 3 underwent transfusions (33.4% vs 18.3%, $p < 0.0001$). Mortality was higher (17.2% vs 4.5%, $p < 0.0001$) and mean hospital (15 days vs 10 days, $p < 0.0001$) and ICU stays (9 days vs 4 days, $p < 0.0001$) were longer in the subgroup receiving MV.

Conclusions: Mechanical ventilation appears to be an easily identifiable early marker for allogeneic blood exposure risk in ICU patients. While the longer ICU stays account for much of this risk, patients receiving MV also appear to undergo transfusions at higher hemoglobin thresholds than patients not receiving MV, at least early in the ICU stay. Justification of this relatively liberal transfusion practice in patients receiving MV will require further study.

Transfusion Practice and Blood Stream Infections in Critically Ill Patients Andrew F. Shorr, MD, MPH; William L. Jackson, MD; Kathleen M. Kelly, MD; Min Fu, MS, MBA and Marin H. Kollef, MD ***Chest.*** **2005;127:1722-1728**

Study objective: To examine the relationship between packed RBC (pRBC) transfusion and the development of ICU-acquired bloodstream infections (BSIs)

Design: Secondary analysis of a large, prospective, observational study of transfusion practice in critically ill patients.

Setting: A total of 284 adult ICUs in the United States.

Patients: Critically ill adults who lacked BSIs both at ICU admission and 48 h after ICU admission.

Measurements and results: BSIs were prospectively tracked in this study, and diagnosis of a new BSI represented the primary end point. Transfusions administered in the ICU prior to development of a BSI were also prospectively recorded. Of 4,892 patients enrolled in this investigation, 3,502 patients lacked BSIs both at ICU admission and 48 h later. Among these individuals, 117 patients (3.3%) had an ICU-acquired BSI. In multivariate analysis adjusting for severity of illness, primary diagnosis, use of mechanical ventilation, placement of central venous catheters, and ICU length of stay, three variables were independently associated with diagnosis of a new BSI: baseline treatment with cephalosporins (odds ratio [OR], 1.84; 95% confidence interval [CI], 1.26 to 2.68), higher sequential organ failure assessment score measured on ICU days 3 to 4 (OR, 1.11; 95% CI, 1.06 to 1.16), and pRBC transfusion (OR, 2.23; 95% CI, 1.43 to 3.52). The relationship between pRBC transfusion and BSI was evident with both small transfusion volumes (OR with 1- to 2-U pRBC transfusion, 1.89; 95% CI, 1.10 to 3.23) and larger transfusion volumes (OR with > 4-U pRBC transfusion, 2.63; 95% CI, 1.52 to 4.53).

Conclusions: pRBC transfusion is associated with subsequent ICU-acquired BSI. Avoiding unnecessary transfusions may decrease the incidence of BSIs.

Anemia, Allogenic Blood Transfusion, and Immunomodulation in the Critically Ill Murugan Raghavan, MD and Paul E. Marik, MD, FCCP ***Chest.*** **2005;127:295-307**

Anemia and allogenic RBC transfusions are exceedingly common among critically ill patients. Multiple pathologic mechanisms contribute to the genesis of anemia in these patients. Emerging risks associated with allogenic RBC transfusions including the transmission of newer infectious agents and immune modulation predisposing the patient to infections requires reevaluation of current transfusion strategies. Recent data have suggested that a restrictive transfusion practice is associated with reduced morbidity and mortality during critical illness, with the possible exception of acute coronary syndromes. In this article, we review the immune-modulatory role of allogenic RBC transfusions in critically ill patients.

Prevention of hospital-associated pneumonia and ventilator-associated pneumonia. *Kollef, Marin H. MD*
Critical Care Medicine. 32(6):1396-1405, June 2004.

Objective: To synthesize the available clinical data for the prevention of hospital-associated pneumonia (HAP) and ventilator-associated pneumonia (VAP) into a practical guideline for clinicians.

Conclusions: There is convincing evidence to suggest that specific interventions can be employed to prevent HAP/VAP. The evidence-based interventions focus on the prevention of aerodigestive tract colonization (avoidance of unnecessary antibiotics and stress ulcer prophylaxis, use of sucralfate for stress ulcer prophylaxis, chlorhexidine oral rinse, selective digestive decontamination, short-course parenteral prophylactic antibiotics in high-risk patients) and the prevention of aspiration of contaminated secretions (preferred oral intubation, appropriate intensive care unit staffing, avoidance of tracheal intubation with the use of mask ventilation, application of weaning protocols and optimal use of sedation to shorten the duration of mechanical ventilation, semirecumbent positioning, minimization of gastric distension, subglottic suctioning, avoidance of ventilator circuit changes/manipulation, routine drainage of ventilator circuit condensate). Clinicians caring for patients at risk for HAP/VAP should promote the development and application of local programs encompassing these interventions based on local resource availability, occurrence rates of HAP/VAP, and the prevalence of infection due to antibiotic-resistant bacteria (Pseudomonas aeruginosa, Acinetobacter species, and methicillin-resistant Staphylococcus aureus).