CRITICAL CARE ALERT®

A monthly update of developments in critical care and intensive care medicine

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Why Physicians Withdraw Ventilatory Support in the ICU

ABSTRACT & COMMENTARY

In this prospective, observational study, Cook and associates recruited 851 patients who were likely to receive mechanical ventilation (MV) for more than 72 hours. They collected a variety of clinical data and severity scores. In addition, they recorded patient preferences for end-of-life care, physicians' estimates of the patients' likelihood of survival, likely functional status at discharge, plus other care variables such as dialysis, vasopressor treatment, whether weaned from ventilatory support, and so on. Some of the variables were followed daily, when appropriate. They found that out of these patients, 539 (63%) were successfully weaned, 146 (17%) died while receiving MV, and 166 (20%) had MV withdrawn in anticipation of death.

To identify a group of patients who were at risk of dying, Cook et al used logistic regression analysis on all patients in the study. The 2 groups for the logistic regression consisted of those who were weaned and those who died with MV or those who had withdrawal of MV in anticipation of death. With this analysis, they identified 300 patients who were at a relatively high risk of dying. Within this group, nearly a third (107 patients; 36%) died after withdrawal of MV, 105 (35%) died with MV in place, and the remaining 88 (29%) were successfully weaned. Among the 300 patients who had a high risk of dying, Cook et al used proportion hazard analysis, a technique used to identify determinants of a future event before the event actually occurs. They used the Cox model to identify determinants of physician-initiated withdrawal of MV.

They found that perhaps the only significant clinical determinant of withdrawal of MV was the presence of inotropic-vasopressor treatment (hazard ratio, 1.78; 95% CI, 1.2-2.66). However, physician judgment that the likelihood of survival in the ICU was less than 10% (hazard ratio, 3.49, 95% CI, 1.39-8.79) and similar likelihood of hospital survival, were significant determinants of withdrawal of MV. Similarly, physicians' predictions of poor functional outcome and poor cognitive function after discharge were significantly associated with withdrawal of MV (hazard ratio, 2.51, 95% CI, 1.28-4.94). If physicians perceived that the patient did not prefer

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advance life support, those patients were likely to have withdrawal of MV (hazard ratio 4.19; 95% CI, 2.57-6.81). The study also showed that patients who were undergoing withdrawal of MV in anticipation of death also were the ones who were more likely to have dialysis stopped or vasopressors withdrawn compared to patients who died with MV in place (Cook DJ, et al—Level of Care Study Investigators and the Canadian Critical Care Trials Group. Withdrawal of mechanical ventilation in anticipation of death in the intensive care unit. *N Engl J Med*. 2003;349:1123-1132).

COMMENT BY UDAY B. NANAVATY, MD

In this prospective observational study, Cook et al used complex statistical techniques to determine what leads physicians to initiate withdrawal of MV. The conventional thinking was postulated to be that physicians would initiate withdrawal of care in elderly patients who had multiple chronic illnesses who were very sick. Cook et al were surprised to find that, except for presence of inotropic-vasopressor therapy, no other markers of severity of illness were significant predictors of physician decisions to initiate withdrawal of MV. Instead, physicians were more likely to initiate withdrawal of MV if they perceived that patients did not want such aggressive care. They were also more likely to initiate withdrawal of MV if they estimated that the likelihood of survival in the ICU or the hospital was less than 10%. They also were more likely to initiate withdrawal if they estimated that the functional or cognitive outcome was likely to be poor. The study included all the eligible patients and used robust techniques to come to the conclusions regarding the practice of physician-(or perhaps the ICU team-) initiated "pro-active" approach to end-of-life care.

Although Cook et al were surprised to find that severity of illness and age were not factors in withdrawal of life support, I frankly was not. I have to admit that I did not understand why Cook et al say age was not an important factor. In fact, when they looked at all the patients who had MV withdrawn in anticipation of death and compared them with all the patients who died with MV in place, their mean age was significantly different (64 yrs vs 60 yrs).

More and more, physicians have realized that the goals of ICU care should be the restoration of functional or qualitative life as opposed to the mere lower "30 day mortality." Also, physicians have accepted the limitations of critical care. As the critical care field and the physicians who provide care gain more experience, the limitations of modern technology are becoming clear. Most ICU physicians can keep the blood pressure where they want to or the pulse oximeter's readings above a predetermined threshold number in the majority of their patients for a reasonably long period of time. Unfortunately, it is hard to decide based on these numbers, which patient will live and which patient will die. Hence physicians have turned to patients and their surrogates to gain insight into their wishes. We also know that the family members are perhaps as poor as physicians are in knowing patients' wishes with respect to end-of-life care.

Beyond knowing what patients want, physicians have tried to have realistic expectations about the care. The problem is—how do you decide if the chances of someone dying in next 30 days are 89% or 91%? Also unknown is the likelihood that a given patient would want to give up aggressive care. Ultimately, the decision to withdraw life support has to be individualized and has to be based on several different factors. We are learning from this large group that there are indeed multiple factors that lead to a decision, after which, not many survive (6 out of 166 patients survived withdraw-

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al of MV in anticipation of death). It is reassuring that physicians are basing this decision on such factors as a realistic likelihood of a positive or negative outcome and patients' perceived preferences. As long as the goals of therapy are discussed and all parties are in agreement, such practice will result in many more "good deaths"—as opposed to the long struggles that sometimes cause distress for physicians and families alike.

The study comes in line with the SUPPORT study that physicians withdraw MV if they are aware of patients' preferences. The study highlights the changes in practice of critical care. In a survey of physicians published in 1994, 15% of physicians said they never withdrew MV. In this study, nearly half of the dying patients had MV withdrawn in anticipation of death, and all of these patients had DNR order in place. DNR orders were also written in nearly half of the patients who died with MV in place. It would be interesting to know as to what led the physicians to estimate the mortality to be greater then 90% and out of all the patients who had estimated mortality of > 90% in the first 72 hours or the first 120 hours, how many actually died. If objective criteria can be delineated to estimate such high mortality with high accuracy in a prospective manner, end-of-life care decisions—and the lives of intensivists—will be much less stressful. ■

Room Assignment and VRE Transmission

ABSTRACT & COMMENTARY

Synopsis: *Among all factors associated with VRE transmission, VRE acquisition may depend on room contamination, even after extensive cleaning.*

Source: Martinez JA, et al. Role of environmental contamination as a risk factor for acquisition of vancomycin-resistant enterococci in patients treated in a medical intensive care unit. *Arch Intern Med*. 2003;163(16):1905-1912.

The recent emergence and spread of vancomycin-resistant enterococci (VRE) is one of the most important issues in critical care today. This study was conducted to further define risk factors for VRE acquisition in the ICU setting, including the role of room contamination. The setting was a 10-bed MICU in a university-affiliated hospital that had implemented active surveillance monitoring for VRE colonization, but continued to experience a high number of VRE cases, of which 80% were believed to be hospital-acquired. Per the surveillance protocol, a rectal swab was to be obtained from all patients within 48 hours of admission and weekly as long as findings of previous cultures remained negative and the patient remained in the unit. Hospital isolation precautions included placing infected patients in a private room, gown and gloves for all room entries, and hand washing with antiseptic soap. Acquisition of VRE was defined as absence of clinical samples positive for VRE at MICU admission, a negative first-rectal culture, and any positive findings at follow-up (after 48 hours).

During the study period, there were 365 admissions, and 169 (46%) underwent screening for VRE colonization. Of these, 31 (23%) acquired VRE during their MICU stay and were termed cases. Two controls were identified for each of 30 of the cases, and these 90 subjects (60 controls, 30 cases) were subjects for the study. The remaining case was not included because an appropriate control could not be identified.

Using multivariate logistic regression, 4 variables were identified as the best independent predictors associated with VRE acquisition: administration of vancomycin before or after MICU admission ($P = 0.03$); having received quinolones before MICU admission ($P = 0.03$); a stay of longer than 1 week in the hospital before transfer to the MICU ($P = 0.04$); and location in a high-risk room ($P = 0.02$). Rooms designated as high risk (2/10) had a variety of contaminated surfaces, including a light switch, toilet flusher, telephone handle, bathroom faucet, and IV pumps.

COMMENT BY LESLIE A. HOFFMAN, PhD, RN

In this study, length of hospital stay before MICU admission, use of quinolones before MICU admission, use of vancomycin before or during MICU admission, and placement in a particular room were the most important predictors for VRE transmission. It is well known that many surfaces in rooms of infected or colonized patients can become contaminated. However, it has been difficult to confirm that surface contamination is an important factor in VRE transmission. Since their first appearance in 1988, VRE have become endemic in many hospitals. Data supporting the use of contact precautions are mixed, with some studies reporting benefits while others do not.

Findings of the present study may be a partial explanation for these conflicting findings. If VRE infection results from suboptimal room cleaning, isolation procedures would not have an effect. Findings of the present study also provide additional support for the role of

exposure to antibiotics as a risk factor for VRE acquisition. Two significant risk factors involved administration of quinolones before MICU admission and IV vancomycin at any time before or after MICU admission. This finding suggests that antibiotic restriction policies in settings such as the ICU, where many patients receive antibiotics prior to unit admission, might be less effective than expected since risk was incurred prior to unit admission.

This study had several limitations. The sample size was moderate and data were collected retrospectively. In addition, less than half (46%) of the patients had complete data for all parts of the surveillance monitoring protocol in terms of obtaining a rectal culture within 48 hours of admission and weekly thereafter until unit discharge. Consequently, some patients may have been colonized at admission but not identified. Nevertheless, failure to identify such patients would be unlikely to influence the association with VRE acquisition and admission to a specific room. An easily modifiable risk factor, room contamination deserves greater scrutiny as a variable that increases risk for VRE acquisition. The cleaning procedure used was standard (phenolic disinfectant on all room surfaces, cleaning for 20-30 minutes), but obviously inadequate. Of note, in an attempt to eliminate environmental contamination as a risk factor, the unit instituted a policy of cleaning rooms in a more thorough manner that took approximately 4 hours to complete. After this change, no environmental samples (10 per room) were positive for VRE. ■

Long-Term Outcome Poor After Prolonged Ventilator Weaning

ABSTRACT & COMMENTARY

Synopsis: *This large, single-center observational study found that 5-year survival of patients requiring prolonged mechanical ventilation and care at an in-patient hospital-based weaning unit was only 19%.*

Source: Stoller JK, et al. Long-term outcomes for patients discharged from a long-term hospital-based weaning unit. *Chest*. 2003;24:1892-1899.

ONLY LIMITED DATA ARE AVAILABLE ON LONG-TERM outcomes after prolonged mechanical ventilation. The primary aim of this observational study was to report 5-year survival rates of such patients. The setting was the Respiratory Special Care Unit (ReSCU) at Cleveland Clinic Foundation (CCF) in Cleveland, Ohio. This 6-bed weaning unit accepts patients only from intensive care units (ICUs) within CCF. It offers 24-hour respiratory therapy services, nurses trained in pulmonary care and rehabilitation, daily sessions with other support staff (physical and occupational therapists, dieticians, other), and noninvasive monitoring. Eligible patients must be hemodynamically stable and free of acute arrhythmias requiring telemetry. They must be good candidates for successful weaning as judged by the attending physician. Patients who are not likely to wean may only be admitted for training for home mechanical ventilation. ReSCU discharge criteria include ventilator independence for > 48 hours, consistent inability to sustain spontaneous breathing (failed trials for > 3 days), or hemodynamic instability requiring transfer to an ICU. Discharge is to home, rehabilitation facility, acute care hospital unit, or long-term care facility for continued ventilatory support without further weaning.

All patients admitted to the ReSCU between August 22, 1993, and August 22, 1996, were included in this study. Causes of respiratory failure were categorized into 5 groups: COPD, nonsurgical (ARDS or chronic lung disease other than COPD), respiratory failure complicating surgical interventions (including ARDS associated with surgical interventions), neuromuscular disease, and other.

Over the 3-year study period, 162 patients (with total 204 admissions) were cared for in the ReSCU. Median hospital length of stay prior to admission to the ReSCU was 29 days (interquartile range, 18-45 days). Fifty-nine percent of patients were female and the mean age was 65 years. Using Stoller and colleagues' categories, these patients most commonly had respiratory failure complicating surgical interventions (50%). Twenty-seven patients (17%) died before discharge from the ReSCU. (Mortality rate among the few patients readmitted to the ReSCU was similar.) Median length of stay in the ReSCU is not presented. Discharge was most commonly to a skilled nursing facility (63%); it is not clear how many patients were still mechanically ventilated at this time. Only 28% of patients were discharged directly to home; 15% of these continued to require mechanical ventilation for at least part of the day.

Five-year follow-up data were available for 94% of patients. Kaplan-Meier survival rates were: 43% (95% confidence interval [CI], 35-51%) at 1 year, 27% (95% CI, 20-34%) at 3 years and 19% (95% CI, 13-25%) at 5 years. The highest risk of death appeared to be within the first 2 years following discharge from the ReSCU. There was a significant association between survival

and year of admission to the ReSCU; survival improved slightly with each year between 1993 and 1996. Increasing patient age was noted to be associated with worse survival after adjusting for variables identified a priori (gender, year of ReSCU admission, and category of respiratory failure). Risk ratio for death per 10 years above 65 years was 1.3.

Stoller et al conclude that long-term survival in this patient population is poor. They suggest further investigation of potential factors for poor survival so that we may affect future outcomes

COMMENT BY SAADIA R. AKHTAR, MD, MSC

Stoller et al's study has a straightforward, simple observational design and is presented clearly and concisely. The 5-year follow-up is nearly complete, and thus the overall survival data are very useful. Other outcomes though were not assessed. Time-to-liberation from mechanical ventilation and ultimate time-to-home are also not reported. Stoller et al do note an association between increasing age and poor outcome, as has been reported previously. They also attempt to assess the effect of cause of respiratory failure on survival. Unfortunately, their method of categorizing causes and their patient numbers do not allow for separation of important causes that may influence outcome. Thus this information adds little to their report. Finally, although they note that the greatest risk of death appeared to be within the first 2 years after discharge from the ReSCU, they do not provide information about these patients' characteristics or causes of death; such data may have been useful for generating hypotheses about factors predictive of outcome. What we are presented with then is an important but limited report of long-term survival in this patient population.

It is quite clear from this and 6 prior observational studies (nicely summarized in the discussion) that long-term survival after prolonged mechanical ventilation is poor. Further support of this alone is unnecessary. These data can help to guide patients and families in their decision-making, but they leave many questions unanswered.

Future studies must evaluate outcomes other than survival: formal long-term quality-of-life measurement is vital and may be what is most important to patients. (This has been done only in a very limited way in 2 of the prior observational studies; Carson et al assessed whether patients are independent and ambulatory at 1 year[1] and Nasraway et al provide results of patients' own rating of their overall health.[2]) Other outcomes such as time to liberation from ventilation, time to discharge to home, rehospitalization (to acute care facilities), and cost analyses are due. The next investigations must also move further toward identifying additional factors associated with outcome and, more importantly, prospectively evaluating these to see whether they are indeed predictive of specific outcomes. Multicenter studies would supply the large numbers of patients required to address these questions in a reasonable time period and would allay some of the issues of generalizability raised by single-center reports. (At least 1 multicenter study is currently on-going.[3])

There are also inadequate data available on the long-term outcomes of patients requiring prolonged mechanical ventilation but being cared for in an acute care ICU rather than a specialized weaning unit. In some regions of the country, this is the only alternative for care for patients requiring prolonged ventilation. It is imperative to determine whether outcomes differ between these 2 settings. This may help to guide future resource allocation and may affect development of facilities for chronic patient care.

Stoller et al's report supports and strengthens the existing observational data on long-term outcomes after prolonged mechanical ventilation. More importantly, though, their work serves as a reminder of the data that we are lacking. I hope this study will inspire and drive us to carefully consider the most appropriate future directions for this area of research. I hope it will be the impetus for developing and carrying out those investigations!

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Special Feature

Editor's Note—*The subject of the following special feature may seem at first glance to be an odd choice for* Critical Care Alert. *However, in this short essay, Dr. Crawford, an intensivist who recently switched from civilian academician to military clinician and teacher, illustrates how critical care in time of war remains a cooperative, multidisciplinary process and involves civilians as well as members of the military. This partic-*

ular conflict—the war in the Persian Gulf—took place half a world away from most of the newsletter's readers. However, this might not be the case in the future, and many of the challenges encountered—such as dealing with large numbers of patients with resistant Gram-negative infections—have relevance to everyone who works in an ICU, regardless of its location. **—DJP**

Operation Iraqi Freedom: Some Lessons Learned From the Gulf

By Stephen W. Crawford, MD

THIS IS A PERSONAL ACCOUNT OF MILITARY MEDICINE in the recent conflict. It reflects a view from a relative newcomer to Navy medicine—me. I learned many important lessons about providing medical care to the participants and bystanders of war, about the character of those involved in all areas of the conflict, and about myself.

Late in my career in medicine, I resigned my professorship at a prominent university to accept a commission as a senior officer in the United States Navy Medical Corps. I pursued this for many reasons: a new challenge, a chance to teach pulmonary and critical care trainees in a different venue, and the opportunity to work with people clearly dedicated to camaraderie and providing service. During my deliberation about a career change, I watched the television images of the World Trade Center towers collapsing on September 11, 2001. I realized I had never served my country and owed my country for many good things in my life. I proudly took my commissioning oath a month later. Never did I anticipate that I would have the opportunity to serve in theater with the skills I have spent years teaching to others.

Operation Iraqi Freedom (OIF) changed life for many of us in the military. This was a large-scale conflict. Because many casualties were anticipated, the services' medical communities were mobilized in force to provide the needed care. While many think this war did not involve the Navy to a great degree, this was a misconception. Many Navy ships provided air-support to the missions, missile launching platforms, naval blockade and interdiction, material support, and transport for Marine troops. Among these ships were numerous "small boys" (destroyers and frigates), several aircraft carriers, and 6 of the Navy's 11 amphibious assault ships. These last are the size of World War II aircraft carriers and serve as troop transport for US Marines and their equipment. The flight decks serve as platforms for large helicopters and vertical take-off jets. In addition, the medical departments serve as hospitals for returning troops and each ship can provide up to 6 operating rooms and 17 ICU beds with lab and radiology support.

The Navy medical teams on the amphibious assault ships are called Fleet Surgical Teams. These are teams of physicians, a surgeon, anesthetist, nurses, corpsmen (the naval team for "medics"), and medical support personnel. When a large number of casualties are anticipated aboard the "amphibs," the Fleet Surgical Teams can be augmented with a Casualty Receiving & Treatment Ship (CRTS) team. This augmentation brings the total number of medical personnel aboard the amphib to more than 100.

Navy medicine supports military actions in other ways as well. Navy medical personnel man 2 hospital ships. These ships are converted oil tankers that provide floating high-level medical support (12 operating rooms, ICU and hospital beds) for up to 1000 patients. The hospital ship USNS Comfort deployed to the North Arabian Gulf (NAG) in support of OIF. Also, the Navy can deploy Fleet Hospitals anywhere in the world. These are mobile medical support facilities that serve as stationary hospitals within miles of frontlines. A colleague of mine was the critical care physician for a Fleet Hospital in southern Iraq. She told me harrowing tales of practicing medicine in tents with blowing sand, intolerable heat, and limited water rations.

The US Marines were to play a major role in the conflict and this meant Navy Medicine was to play a major role. The Navy not only has the transport ships for the Marines but they also provide all their medical support. No Marine unit undertakes any mission without personnel from Navy Medicine in their numbers. Navy Field Surgical Support Groups (FSSGs) accompany Marine battalions. The FSSG concept now includes the capabilities to provide surgical interventions (Shock Trauma Platoons) within minutes of the battlefield. The average battle casualty in OIF received surgical treatment in less than 1 hour and the rate of deaths due to war wounds was the lowest in the history of modern warfare. The importance and seriousness of this assignment for Navy personnel are highlighted by the deaths of 2 Navy corpsmen while tending to Marines within battle zones.

As the beginning of OIF drew near, I knew that I would be called on to leave the comfort of the large Medical Treatment Facility at which I worked in San Diego and deploy to the NAG on a CRTS as a critical

care physician. After nearly 25 years in medicine, I tried to prepare to be a military doctor. When our team arrived aboard the USS Boxer, we worked feverishly to create a cohesive team that could effectively deal with the large influx of casualties we thought would be flown from the battlefield to our decks. The prospects were high for chemical and biological injuries, as well as the typical battle wounds. As I tried to sleep in my "rack" in the stateroom I shared, I listened to the sounds of flight crews on the flight deck directly above me, and I dreaded the thought of treating young, previously healthy soldiers and marines.

When the war began we watched the television images in the wardroom just as the rest of the world did; and we waited for casualties. For days we saw the Navy and Marine helicopter crews aboard our ship come and go from their missions into Iraq. I was in awe as young men and women with M-16 rifles over their shoulders and 9-mm pistols strapped to their legs coolly went about their "business," day and night. We heard some of their tales from the war zones. None of them thought any special or heroic about their actions. It was "just their job." In the meantime, we had very few casualties to treat and were getting restless. The casualties were fewer than expected and were not coming out to the medical facilities on the amphibs. Casualties were going to the hospital ship USNS Comfort. They were busy—very busy.

Finally, several surgeons, nurses, corpsmen, and critical care physicians were mobilized from various CRTS teams and we helicoptered over to help out. The dozens of patients in the ICUs aboard the hospital ship were the largest collection of sickest patients I had seen in my career. Patients ranged from coalition forces, to enemy combatants, to civilians injured both as a result of the war and routine illness and usual civilian accidents. For some of the wounded, it was unclear whether they were enemy combatants or not, or even if they were Iraqi citizens. Some of the combatants arrived from neighboring countries. All ages of patients were treated. Any patient brought to any coalition medical station in Iraq was stabilized, cared for and transported to the hospital ship if needed. This included abandoned children without obvious trauma. Since there were few functioning civilian medical facilities existing in Iraq, many were flown to the USNS Comfort. Possibly the most tragic among these were the more than half-dozen civilians with extensive burns who required mechanical ventilatory support. I am sure the "burn unit" aboard ship rivaled that in any severity of any major burn center in the States.

Coalition forces brought to the ship were an amazing group of individuals. Each with serious injuries requiring surgical support, they were quickly treated with a higher level of care than I would have thought possible aboard a ship at sea. These men, heroes every one of them in my mind, were humble and almost apologetic for their wounds. Medivac flights to land-based medical facilities closer to home were quickly arranged as soon as the wounded were stable.

The same movement of patients was not true for the civilians. There were few options for transport to other medical facilities in the region. The devastated Iraqi medical infrastructure was unable to care for many of these severely injured citizens. The inability to move patients through a system created a large workload aboard the ship. This situation created a strain not only on the system but also on the staff. The most memorable experience for me was the way the Navy physicians, nurses, support personnel, and corpsmen responded. Young men and women worked tirelessly under some of the most difficult situations with incredibly ill patients and never complained. Improvisation was the name of the day since materials were limited on the ship and the level and variety and ages of the patients were not anticipated completely. Certainly, it was not anticipated that patients (especially the children) would remain aboard as long as they did. Nurses, surgeons, physical therapists, and corpsmen became very creative in devising ways to tend to the variety of burns, injuries, and infections with limited supplies. Their grace under pressure and dedication to completing the mission was inspiring. I suspect it was only a relative lack of experience that allowed some of the more junior members of the crew to tolerate the conditions—they didn't realize just how difficult the situations were! More than once I fell asleep with tears in my eyes as I thought about the plights of the patients and dedication of the crew.

An already difficult environment was made worse by the presence of a serious multidrug resistant Gram-negative bacterial infection of many of the wounded coming out of Iraq. The *Acinetobacter* organism appears to be endemic in that country. The infection was easily transmitted in the crowded patient areas and frequently caused sepsis in the more critically wounded. Infection control efforts compounded an already difficult situation. Resupplying the ship with sophisticated antibiotics tested the system and the physicians.

It is likely that the patients with these serious infections would not have survived to reach a higher level of care had they not been treated promptly near the battlefield. The routine use of broad-spectrum antibiotics may have been selected for specific virulent organisms.

These infections may be the price of "success."

The Lessons I Learned

1. In war nothing goes as planned. Preparing for all contingencies is impossible and this tenet applies to medicine as well.
2. Humanitarian missions likely will dominate the medical mission and will likely involve children's issues.
3. The typical war wounds are penetrating injuries and burns. This basic fact remains even though the tools of war change.
4. A key to improving survival in wartime is rapid transportation of casualties to higher levels of care.
5. The nature and types of infections continue to change, due to the rapidity of medical care at the front. Injuries that were previously fatal are now routinely treated quickly and prophylactic antibiotics given near the battlefield. The more wounded we save, the more we treat for serious infections we otherwise would not see.
6. Medical providers who are dedicated can accomplish amazing feats in urgent wartime situations with less than "ideal" equipment.

These experiences have changed my concept of what is required to care for the critically wounded. The dedication of the caregivers is paramount and trumps any technology. ■

Note: The views and opinions expressed are not necessarily those of the Department of Defense or the United States Navy.

Suggested Reading

1. *MMWR Morb Mortal Wkly Rep*. 2003;52(36):857-859.

CME / CE Questions

21. In the study by Stoller et al of long-term outcomes after prolonged ventilation, mortality was significantly associated with which of the following characteristics:

a. Age
b. Gender
c. Length of intubation
d. Length of hospitalization
e. ARDS

22. Factors identified as independent risk factors for VRE acquisition included:

a. MICU admission.
b. Age older than 70 years.
c. Immunosuppression prior to MICU admission.
d. Triple antibiotic therapy during MICU admission.
e. Room contamination from a prior patient with VRE.

23. According to the study by Cook et al, physicians would be most likely to withdraw mechanical ventilation in which of the following settings?

a. An elderly patient with pneumonia has a high leukocyte count and is not responding to aggressive care in the first 48 hours
b. A young, comatose, drug overdose patient who does not improve in the first 5 days of treatment
c. An end-stage renal disease patient with septic shock who requires vasopressor treatment during dialysis
d. A patient they perceive not to want life-prolonging treatment.

24. Many wounded combatants and civilians in the Iraq war had serious drug-resistant infections with which of the following organisms?

a. *Acinetobacter* species
b. *Staphylococcus aureus*
c. *Klebsiella* species
d. *Pseudomonas* species
e. *Yersinia* species

25. How long after medical assistance was initially requested did the average battle casualty in the Iraq war receive surgical treatment?

a. 8-12 hours
b. 4-6 hours
c. 2-4 hours
d. 1-2 hours
e. < 1 hour

Answers: 21.(a); 22.(e); 23.(d); 24.(a); 25.(e)

CME / CE Objectives

After reading each issue of *Critical Care Alert*, readers will be able to do the following:

- Identify the particular clinical, legal, or scientific issues related to critical care.
- Describe how those issues affect nurses, health care workers, hospitals, or the health care industry in general.
- Cite solutions to the problems associated with those issues.

In Future Issues:

High FiO_2 in Acute Asthma