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CRITICAL CARE ALERT®

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

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Protocol Weaning in 'Unweanable' Patients

ABSTRACT & COMMENTARY

This report comes from barlow respiratory hospital, a center in Southern California for weaning patients from prolonged mechanical ventilation in the post-ICU setting. Scheinhorn and colleagues devised a complex, respiratory therapist-implemented, patient-specific weaning protocol, tailored specifically to their patient population and practice approach. They then prospectively tracked patient outcomes, variance from the protocol, and compliance of both therapists and physicians during the protocol's first 18 months, compared with data from the last 2 years prior to protocol implementation.

A total of 271 "unweanable" patients were transferred to Scheinhorn et al's institution from ICUs of other hospitals during the protocol period, of whom 252 were considered potential weaning candidates; the historical control group comprised 238 patients who were also considered candidates for weaning. The same physicians treated both cohorts of patients; 46 respiratory therapists worked in the unit during the protocol period.

The duration of mechanical ventilation prior to transfer was similar in the 2 groups of patients. A total of 55% of the patients were successfully weaned during the protocol period, as compared to 58% during the preprotocol period; 18% and 11% were determined to be ventilator dependent, and 27% and 31% of the patients died, respectively (all differences not statistically significant). Protocol variances by physicians and respiratory therapists during 9135 total ventilator days during the protocol period comprised 324 and 136 ventilator days, respectively. The median time to wean was 17 days under the weaning protocol, as compared to 29 days prior to its implementation ($P < .001$). More rapid weaning (by an average of 16 days) for a greater proportion of patients who were ultimately weaned saved 1112 ventilator days in 70 patients per year, for a total of 570 ventilator days of hospitalization saved per year in 22 patients. (Scheinhorn DJ, et al. *Chest.* 2001;119:236-242.)

■ COMMENT BY DAVID J. PIERSON, MD, FACP, FCCP

The special feature in the March 2001 issue on cost-effective

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respiratory management under managed care briefly summarized the mounting evidence that weaning from mechanical ventilation can be shortened and its associated costs reduced through the use of protocols carried out at the bedside by respiratory therapists and nurses.[1] This topic has recently been reviewed more comprehensively.[2] This study provides further evidence that weaning protocols can be effective, even in patients who have failed multiple weaning attempts and been transferred to a center of special expertise in caring for them.

Scheinhorn et al at Barlow Respiratory Hospital have unquestioned expertise in weaning the "unweanable" patient, having previously reported their experience with 1123 such patients.[3] They are to be commended for the present study, in which they show that implementation of a therapist-driven weaning protocol can shorten the weaning process, even in a center of such recognized expertise. The key is not the knowledge and experience of the physicians caring for the patients, but the hour-by-hour availability of decision-makers at the bedside. Respiratory therapists are not inherently better at ventilator weaning than doctors. They are, however, at the bedside more continuously, and can assess patients more frequently, moving them along more rapidly as improvement occurs—provided they are empowered to do so by a protocol authorized by the physician.

Although the physician may spend considerable time at the bedside when a patient is critically ill and unstable, once that patient improves and moves into the weaning phase of ventilatory support, the physician may be physically present only once or twice a day. If changes in ventilator settings can be made only at such times, it is hardly surprising that weaning a patient who is rapidly improving will take longer than if the physician (or someone else who could modify the ventilator settings) were present 2 or 3 times as frequently. Weaning protocols, developed with physician participation and tailored to the patient population and clinical practice of the individual institution, permit respiratory therapists and/or nurses to make the same assessments and ventilator changes as would be made if the physician were physically present.

It has been estimated that somewhere around 2 million patients undergo mechanical ventilation each year in the United States. A recent point-prevalence study of mechanical ventilation around the world found that, at any given moment, about half of all ventilated patients are considered by those caring for them to be in the weaning process.[4] If the average patient spends 5 days on the ventilator, then weaning is in process for 5 million patient-days each year in this country (2 million patients ? 5 days each ? 50% spent weaning). In this context, the economic implications of even a slight reduction in average weaning time are staggering, something that is unlikely to be lost on those who pay for ICU care and increasingly regulate it.

Weaning protocols are here to stay. As the evidence of their safety and cost-effectiveness mounts, ICUs and respiratory care departments that have not yet implemented such protocols are likely to come under increasing scrutiny, not only from clinicians interested in providing the best possible patient care, but also from hospital administrators and third-party payers focused on minimizing the costs of providing that care. ❖

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VICE PRESIDENT/GROUP PUBLISHER: Donald R. Johnston.

EDITORIAL GROUP HEAD: Glen Harris.

MANAGING EDITOR: Robin Mason.

ASSOCIATE MANAGING EDITOR: Neill Larmore.

COPY EDITOR: Melissa Lafferty.

MARKETING PRODUCT MANAGER: Schandale Kornegay.

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Customer Service: 1-800-688-2421

Customer Service E-Mail Address: customerservice@ahcpub.com

Editorial E-Mail Address: melissa.lafferty@ahcpub.com

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Please call **Robin Mason,** Managing Editor, at (404) 262-5517 or **Melissa Lafferty,** Copy Editor, at (404) 262-5589 or e-mail at melissa.lafferty@ahcpub.com between 8:30 a.m. and 4:30 p.m. ET, Monday-Friday.

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Methylene Blue in Hepatopulmonary Syndrome

ABSTRACT & COMMENTARY

Synopsis: Intravenous methylene blue improved hypoxemia and hyperdynamic circulation without apparent adverse effects in patients with end-stage liver disease and the hepatopulmonary syndrome.

Source: Schenk P, et al. *Ann Intern Med.* 2000; 133(9):701-706.

Schenk and associates at the university of Vienna administered methylene blue intravenously to 7 patients with the hepatopulmonary syndrome. They postulated that methylene blue, an oxidizing agent that blocks the stimulation of soluble guanylate cyclase by nitric oxide (NO), would inhibit NO-induced pulmonary vasodilation and, thus, improve arterial oxygenation and decrease the hyperdynamic state in these patients. The patients all met the following criteria for the hepatopulmonary syndrome: advanced hepatic cirrhosis, absence of intrinsic pulmonary disease, increased $P(A\text{-}a)O_2$, and positive contrast-enhanced echocardiogram suggesting intrapulmonary vascular dilation. In each patient, pulmonary artery and systemic arterial catheters were inserted, and methylene blue, 3 mg/kg body weight, was infused intravenously over 15 minutes.

Mean $P(A\text{-}a)O_2$ in these patients was 49 mm Hg breathing air before the intervention, with a mean right-to-left shunt fraction of 41%. After methylene blue administration, PaO_2 on room air increased in every patient, from a baseline of 58 ± 2.5 mm Hg to 74 ± 11.5 mm Hg after 5 hours (P = .006). Mean $P(A\text{-}a)O_2$ and right-to-left shunt decreased by approximately 20 mm Hg and 16%, respectively, with a maximum effect of 5 hours after infusion. Mean pulmonary arterial pressure increased from 20 to 23 mm Hg (P = .028), and cardiac output decreased from 10.6 to 8.6 L/min (P = .008); pulmonary artery wedge pressure and systemic blood pressure did not change. The effect on arterial oxygenation remained significant even after 10 hours. The only detectable side effect was a blue-green discoloration of the urine lasting 1-2 days.

COMMENT BY DAVID J. PIERSON, MD, FACP, FCCP

As many as one-fourth of patients with end-stage liver disease (ESLD) develop hypoxemia due to the hepatopulmonary syndrome, defined by the triad of chronic liver disease, hypoxemia, and intrapulmonary vascular dilation in the absence of intrinsic pulmonary disease.[1] This syndrome is important in the ICU because of the frequency with which patients with ESLD are admitted for upper gastrointestinal bleeding and other problems, and because hypoxemia caused by the hepatopulmonary syndrome is notoriously difficult to correct.

Hypoxemia in this setting also may confound usual management for acute respiratory failure, as when a patient with ESLD develops pneumonia or another acute pulmonary process. In circumstances such as this, arterial oxygenation as assessed by the PaO_2/FIO_2 ratio may remain sufficiently impaired in the presence of the hepatopulmonary syndrome that usual thresholds for decreasing positive end-expiratory pressure or ventilator weaning may not be reached, prolonging mechanical ventilation and ICU stays.

Mainly this is a problem of recognition in that once the diagnosis of hepatopulmonary syndrome is made, clinicians can modify their usual criteria for oxygenation and usually wean patients successfully (although they may remain hypoxemic) once the acute pulmonary problem has improved. However, it would be good to have more effective therapy for the gas exchange impairment of the hepatopulmonary syndrome itself. This preliminary study suggests that methylene blue, a readily available and apparently nontoxic agent, may prove helpful in this regard. ❖

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Are Aneroid Sphygmomanometers Accurate?

ABSTRACT & COMMENTARY

Synopsis: In the presence of a protocol of annual maintenance, aneroid sphygmomanometers in regular clinical use were accurate to within 0.5 mm Hg (95% CI, < 1 mm Hg) when tested using a device calibrated against a mercury sphygmomanometer.

Source: Canzanello VJ, et al. *Arch Intern Med.* 2001; 161:729-731.

Because of increasing concerns over the personal and environmental hazards of mercury, mercury sphygmomanometers have been replaced by aneroid devices in many health care settings. Previous studies have shown that aneroid sphygmomanometers tended to be less accurate than their mercury counterparts, particularly with frequent or rough use. Because of this, Canzanello and colleagues undertook this study to determine whether the

aneroid devices in their institution remained acceptably accurate under their existing maintenance program.

The study was done at the Mayo Clinic's 2 principal inpatient facilities in Rochester, Minn. During a 4-month period, as part of the institutions' routine maintenance program, 248 aneroid sphygmomanometers (17%) out of approximately 1500 devices that had replaced mercury sphygmomanometers over the previous 6 years were selected for study. Each device was visually inspected for damage and was replaced if it did not read 0 prior to testing. Canzanello et al used a digital pressure and vacuum meter, calibrated against a mercury sphygmomanometer, to test each aneroid device at 20 mm Hg intervals between 60 and 240 mm Hg.

Pressure values from the aneroid device were virtually identical over the pressure range tested ($r = 0.99$; $P < .001$), underestimating those of the reference device by a mean of 0.5 mm Hg (95% CI, 0.3-0.7 mm Hg). Virtually 100% of the values from the aneroid sphygmomanometers were within 4 mm Hg of those obtained on the reference device, which is the range recommended by the Association for the Advancement of Medical Instrumentation. Only 1 sphygmomanometer was replaced because of a resting reading different from 0. Canzanello et al concluded that the aneroid sphygmomanometers in clinical use at their institution, maintained according to institutional protocol, provided accurate pressure determinations when compared with a digital pressure and vacuum meter.

■ COMMENT BY DAVID J. PIERSON, MD, FACP, FCCP

Although aneroid sphygmomanometers are widely used in clinical settings, including the ICU, the mercury sphygmomanometer has remained the gold standard for accuracy. Several studies have documented inaccuracies of potential clinical importance with aneroid devices that are not properly maintained.[1,2] In one survey of general practitioners,[3] only about half had serviced their sphygmomanometers within 1 year and one-fourth of the devices had never been serviced at all during a mean of 6 years of use. I am unaware of published studies of sphygmomanometers in use in the critical care setting, although there is no reason that use in that environment would not pose the same problems as elsewhere.

The good news is that, with a program of regular inspection and maintenance (in the case of Canzanello et al's institution, once a year), aneroid sphygmomanometers are plenty accurate for clinical purposes. It is important to point out that only fixed, wall-mounted devices were included in this study, and one might expect more portable devices to receive more jars and jolts and hence be more likely to become inaccurate. Despite widespread direct monitoring of systemic arterial blood pressure via catheter-connected pressure transducers, indirect measurement using a sphygmomanometer remains an indispensable tool in the ICU. It is reassuring to know that replacement of mercury sphygmomanometers with their aneroid counterparts has not meant sacrificing accuracy, at least when the devices are properly inspected and maintained. ❖

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Outcomes of ICU Care in Adults With Cystic Fibrosis

ABSTRACT & COMMENTARY

Synopsis: This report documents the outcomes of 136 medical ICU admissions of adult patients with severe cystic fibrosis, managed in a large CF center with a lung transplantation program. The results support the conclusion that such care is as appropriate and effective for this group of patients as for many others commonly managed in the ICU.

Source: Sood N, et al. *Am J Respir Crit Care Med.* 2001;163:335-338.

Sood and colleagues at the university of north Carolina reviewed all admissions of patients with cystic fibrosis (CF) to their medical ICU from 1990 through 1998, representing the first 9 years since establishment of a lung transplant program at that center. Patients admitted after lung transplantation were excluded. In addition to patient demographics, diagnoses, and severity of underlying disease, Sood et al examined the interventions used, complications, and survival data.

During the study period, 76 adults with CF (41 females, ages 16-42 years; mean 26 years, and 35 males, ages 18-45 years; mean 30 years) were admitted to the medical and respiratory ICUs a total of 136 times. Primary admitting diagnoses were exacerbations of CF with respiratory failure (48% of admissions), massive hemoptysis (24%), antibiotic desensitization (22%), pneumothorax (2%), and miscellaneous (4%, including 2 suicide attempts). In the course of 65 admissions for CF exacerbation with acute respiratory failure, ventilatory support was used in 50. Tracheal intubation was carried out in 32 episodes in 30 patients on 5 occasions after failure of

noninvasive ventilation; in 13 other episodes, intubation was avoided by using mask ventilation.

Among the patients requiring intubation, 12 (40%) died. Mean duration of ventilatory support for these patients was approximately 10 days (range, 1-45 days) for both survivors and nonsurvivors. Of the patients admitted to the ICU with respiratory failure, 17 (40%) received lung transplants, and 14 of these (82%) were alive 1 year later; without transplant, 3 patients (7%) were alive and 3 (7%) were dead after 1 year. Sex, body mass index, baseline pulmonary function, and respiratory bacteria did not correlate with survival. Sood et al conclude that ICU care for adult patients with CF who have potentially reversible complications is appropriate and effective. They also conclude that ventilatory support is appropriate for at least some of these individuals who are candidates for lung transplantation.

■ COMMENT BY DAVID J. PIERSON, MD, FACP, FCCP

A survey in the late 1970s documented very poor outcomes among CF patients who required mechanical ventilation.[1] In those days, the recommendation of some authorities for CF patients with severe lung disease and respiratory failure was palliative care only. Things have definitely changed. CF is no longer a disease managed just by pediatricians. Median survival for individuals with CF is currently somewhere in the fourth decade, with increasing numbers in their 40s and beyond. This means that patients with CF are now managed by clinicians caring for adults, and that hemoptysis, acute respiratory failure, and other complications are increasingly encountered in the medical ICU. It is important that old notions of the futility of aggressive care in these circumstances be discarded, as emphasized by the results of this study.

In this series, 60% of the CF patients with acute respiratory failure who required intubation and ventilatory support survived through to hospital discharge. This is comparable to current reported survival rates in the acute respiratory distress syndrome, and definitely better than for patients with respiratory failure complicating solid-tumor or hematologic malignancy. With the prospect of lung transplantation for at least some of these patients, it is reasonable to expect not only a return to the previous state of severe functional impairment but—for some anyway—achievement of dramatically improved health status, if not a completely normal life.

It is important to note that some factors that might have been expected to predict a poor outcome in these patients, such as severity of airflow obstruction and low body mass index, were not reliable predictors of a poor outcome. The same was true for respiratory tract colonization with *Staphylococcus aureus*, *Burkholderia cepacia*, and antibiotic-resistant *Pseudomonas aeruginosa*.

This paper reports findings on a highly selected population of CF patients, managed at a large referral center with specialized expertise in this disease and a major lung transplant program. The fact that 60% of these patients with respiratory failure made it out of the hospital despite the need for intubation and mechanical ventilation does not mean that the same would necessarily happen at my hospital, or yours. The results reported by Sood et al show what can be achieved at a highly specialized center. Nonetheless, it is encouraging to note that the outlook for CF patients with critical illness is far better than it was just a few years ago. This is reflected in the title of the editorial accompanying this paper: "Cystic fibrosis critical care: No longer an oxymoron."[2] ❖

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Special Feature

Changing Clinician Behavior in the ICU

By Gordon D. Rubenfeld, MD, MSc

A nurse manager in an 18-bed medical-surgical ICU wants to implement a sedation-holiday protocol in his ICU.

An intensivist in a 14-bed academic medical ICU wants every patient in her ICU with acute lung injury to be identified and receive lung protective ventilation with low tidal volumes.

The infection control committee at a large community hospital wants every central venous catheter placed with appropriate barrier technique.

Proponents of these initiatives will encounter a common barrier: to accomplish their goals they will have to figure out how to get clinicians to change their behavior.[1-6] It may seem that the biggest impediment to quality care, particularly in critical care, is knowing what the best practices should be. Once clinicians know what should be done, they will simply follow the Nike dictum, Just do it. Unfortunately, as anyone knows who has tried to quit smoking, lose weight, or remember to take a morning vitamin—or as anyone knows who has worked with patients to try to improve adherence to a medical therapy—know-

ing and doing are only distantly related.

In a strange way, critical care has the advantage of only having to worry about clinician compliance to practice recommendations. Patient adherence, an important barrier to improving outcomes in ambulatory medicine, is generally not an ICU problem. However, critical care does pose unique barriers to changing behavior. The heterogeneous group of clinicians who work in ICUs and come from different clinical backgrounds with varying levels of experience in critical care are a difficult audience to reach with any intervention designed to change behavior. A lack of outcome data on treatment efficacy for many of the syndromes routinely encountered in the ICU leaves a great deal of room for debate on which practices to promote. However, recent studies on ventilatory strategies in ARDS, sedation use by protocol, noninvasive ventilation, the use of red blood cell transfusions, and the pharmacologic therapy of sepsis place a new burden on our shoulders: can we practice what we read?

First Things First

There are two essential factors that must be in place before implementing a program to change clinical behavior. First, there must be some agreement on the behavior that needs changing. It doesn't make much sense to put together an extensive program to increase the use of nitric oxide in adults with ARDS, when there is no agreement that this therapy benefits patients with the disease. The process of identifying the clinical priorities for a given ICU and agreeing on what should be done is itself a behavioral change intervention.

This process can be facilitated by the second essential factor in implementing change: data. Knowing what you're doing and how well it is working is essential to programs designed to change practice. What percentage of patients in your ICU receive DVT prophylaxis? What percentage of patients with ARDS are on appropriately low tidal volumes? How often are central lines placed without full barrier precautions? How often do attending physicians meet with family members to update them on patient condition? How much indiscriminate use of vancomycin is there in the ICU? Obviously, it is much easier to gather data on antibiotic use than on quality of communication, but, without data it will be difficult to convince your colleagues that there is a need for change and it may be even harder to show them the benefits of change.

Teach Them

Given the number of years that clinicians spend in school and going to class, continuing medical education would seem an ideal opportunity to inform clinicians and change behavior. Unfortunately, the evidence shows that the simplest forms of education—lectures and journal articles, including, unfortunately, what you are reading right now—have a negligible effect on practice.[1] There are a number of problems with these forms of education: they are too passive, they do not specifically address the learner's needs, and they do not incorporate a plan for action. This is rather distressing news for those of us who give lectures and write articles, but it does not mean that all education is ineffective. Small group and "hands-on" sessions that engage clinicians in active learning and provide an opportunity to practice and build confidence can be more effective. You should not expect much from having your critical care committee adopt a guideline and place it in your official book of clinical practice guidelines which sits unread in the physicians' workroom.

Pharmaceutical companies have known for years that direct, one-on-one "detailing," by sales people armed with articles, graphics, and perhaps a few trinkets, can have a profound effect on clinician practice. In an effort to duplicate this success, several investigators have shown that "academic detailing" by pharmacists or other clinicians, similarly armed with articles and graphics, can have a strong effect on clinical practice. Another approach is to enlist the teaching and support of a local opinion leader. Every ICU has them. This is the physician, nurse, or respiratory therapist that everyone turns to for questions on difficult cases. When information is delivered by this trusted individual, clinicians tend to listen and change their practice.

Pay Them

It may seem mercenary, but an obvious way to change behavior is to provide appropriate incentives. If you were paid $500 for every patient who successfully quit smoking, imagine how you might change your practice. Payment incentives can have a profound effect on physician practice, sometimes leading to rather perverse incentives for physicians to generate demand for their own procedures. Many insurance companies are beginning to link reimbursement to achieving certain population health goals. A number of managed care organizations explored a variety of "payment withhold" strategies where physicians were paid a bonus out of the money that was not expended on patient care. Financial incentives for clinical care need to be carefully designed, precisely because they are so potent. The key is not to provide incentives to do "more" or to do "less" but to do what's right.

Incentives need not be strictly financial. Clinicians will respond to peer pressure as a form of reward and punishment. For example, a growing body of evidence points to the benefits of keeping mechanically ventilated

patients at a 45° angle to reduce ventilator associated pneumonia. The ICU nurse plays an important role in patient positioning. What if you had spot position checks on mechanically ventilated patients and gave coffee coupons to the nurses whose mechanically ventilated patients were at 45°?

Remind Them

Prompts are an effective strategy for changing behavior. Having another clinician or a computer keeping an eye on practice and providing a reminder can work wonders. Imagine a morning phone call from a respiratory therapist to an ICU physician with a reminder that a patient meets criteria for ARDS but still has static airway pressures of 40 cm H_2O. Or a computer generated page that informs the physician that a patient is on 3 drugs that all prolong the QT interval. One of the clinical pharmacists at an institution at which I worked used to leave a note in the chart "reminding" the ordering physician about the appropriate use of therapeutic drug level tests. A bright orange sticker on a central venous catheter kit might remind clinicians about appropriate barrier technique.

The problem with this form of concurrent feedback is that it can be very expensive. Expanding the role of other clinicians to track care and provide reminders can cost a lot of money. Computerized prompts have been shown to be effective and can be much less expensive. Computerized prompts particularly lend themselves to evaluation of drug interactions and fairly simple algorithmic evaluations.

Make it Easy for Them

Perhaps one of the most effective techniques for changing behavior and one that should be part of care in every ICU involves strategies that basically make it easy to do the right thing. The most common example is prewritten admission orders. Physicians can certainly deviate from the check boxes and prewritten doses and should be encouraged to do so when appropriate. However, it is much easier to remember to write for prophylaxis against deep venous thrombosis and gastric ulcers, for raising the head of the bed 45°, and for drawing appropriate daily laboratory tests when the orders for these things are prewritten.

Treatments that require titration, such as sedation, lung-protective ventilation for ARDS, anticoagulation, and insulin dosing are all better performed when a protocol is used to guide care that removes the physician from every step of the process. Empowering other members of the ICU team to guide care ensures that changes occur rapidly and smoothly, freeing physicians to address other aspects of care. Perhaps the area that has been most influenced by this approach in critical care has been the benefits attributed to weaning protocols. The focus of the weaning literature has been away from novel strategies of exercising respiratory muscles toward effective and universal deployment of protocols to evaluate whether patients are ready for extubation.

Academic clinicians may be concerned that all of these preprinted orders and nonphysician clinician based protocols will remove an essential aspect of training from house officers. Physicians-in-training may not learn important skills by losing the valuable experience of choosing a heparin dose or interpreting a set of weaning parameters. Given the wealth of data showing the benefits of protocolized care in specific areas and the value of learning to work on a multidisciplinary critical care team, not to mention a growing body of literature that shows that protocols actually contribute to house staff learning, I suspect that these concerns are unwarranted compared to the demonstrated benefits. House officers need to learn to work with other clinicians in using protocols and to learn when to over-ride protocols since they will use, or should be using, them when they leave the academic medical center. One excellent approach is to involve house officers in the development and implementation of protocols. This teaches them 2 important lessons: the value of protocolized care and how to implement it in the critical care setting.

There are other interventions that fall under the category of "Make it easy for them." A number of organizational changes in the ICU have been shown to change behavior and outcomes. The most drastic of these is closing the ICU to all admissions except from a selected attending staff who are committed to critical care. Other options are developing teams with specific expertise. For example, a large hospital with many critical care beds may have a line placement team consisting of an intensivist and nurse whose only responsibility is placing and caring for central venous catheters. Other examples include special care units for "chronically critically ill" patients or for hopelessly ill patients. The rationale for these special care units and teams is that clinicians who see a high volume of patients with a specific illness tend to have better outcomes caring for them.

All of the Above

Which of the above interventions is the most effective at changing behavior? The evidence base is not mature enough to make this judgement, but most authors believe that incorporating more than one approach into a multifaceted intervention is most effective. For example, in an attempt to increase the use of lung-protective venti-

lation for patients with ARDS an ICU might develop a low-tidal volume ventilation protocol adapted from those presented in clinical trials; educate nurses, physicians, and respiratory therapists on the use and benefits of lung-protective ventilation; and train respiratory therapists to screen patients' physiology and chest radiographs for evidence of ARDS and to place reminder calls to physicians about the ventilator protocol. This incorporates education, reminders, and a protocol.

Ultimately, the best research in the world does patients little good unless it can be translated into practice. The ICU presents unique challenges and opportunities for implementing best practices. Fortunately, committed practitioners can adopt proven techniques to change practice and improve outcomes in their own ICUs. ❖

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Attention Subscribers. . .

A special supplement to Critical Care Alert titled "Antibiotics Anonymous Redux" is included with this edition, as a bonus to our subscribers. The supplement takes a tongue-in-cheek look at a problem facing many physicians: over-prescription of antibiotics. Here is an editorial note from Stan Deresinski, MD, editor of Infectious Disease Alert:

The problem of antibiotic resistance continues to worsen. An important contribution to this problem is the inappropriate prescription of antibiotics by physicians. For example, excess prescription of antibiotics for respiratory tract infections, particularly in children, has been identified as an important factor in the emergence of penicillin-resistant Streptococcus pneumoniae. Indeed, it has been suggested that some physicians have lost control over their antibiotic prescribing—that they have become, in effect, antibiotic dependent. I have, as a consequence, devised a questionnaire for the diagnosis of this dreaded addiction afflicting practicing physicians. If the answer to one or more of these questions is yes, you have a problem!. . .❖

CE/CME Questions

6. When administered to patients with the hepatopulmonary syndrome, methylene blue:
   a. improved arterial oxygen tension.
   b. decreased cardiac output.
   c. did not change pulmonary capillary wedge pressure.
   d. turned the urine blue.
   e. All of the above

7. When patients who have failed repeated attempts at ventilator weaning are transferred to a specialized weaning center and managed by physicians with extensive experience in this setting:
   a. creation and implementation of a weaning protocol is unnecessary in view of the specialized expertise of the physicians involved.
   b. use of a respiratory therapist-managed weaning protocol significantly decreases weaning time.
   c. use of a respiratory therapist-managed weaning protocol significantly increases weaning time.
   d. None of the above

8. Which of the following is probably going to have the most effect in changing practice?
   a. Grand rounds lecture to all hospital staff physicians
   b. Attendance at a certified continuing medical education session at an international conference
   c. One-on-one detailing visits by a pharmaceutical company representative
   d. Evidence-based guideline distributed to all physicians with ICU admission privileges
   e. Internet-based continuing medical education course with a written test

9. The most common reason adult patients with cystic fibrosis were admitted to the ICU was:
   a. acute respiratory failure.
   b. massive hemoptysis.
   c. pneumothorax.
   d. attempted suicide.
   e. antibiotic desensitization.

CE/CME 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:

Acute Asphyxic Asthma

CRITICAL CARE Plus

EXPANDING YOUR FOCUS IN INTENSIVE CARE

Pain in the ICU: How Much Is Too Much?

Self-Report Study Says Current Level Too High

Patients' experience of their symptoms needs to be considered as a "cost" of icu treatment, according to Judith E. Nelson, MD, JD. Nelson, associate director of the medical intensive care unit and assistant professor of medicine in the division of pulmonary and critical care medicine at New York's Mt. Sinai School of Medicine, and colleagues recently studied 100 consecutive patients admitted to the medical intensive care unit at Mt. Sinai Hospital.[1] All study subjects had present or past cancer.

Fifty of the 100 patients enrolled in the study were able to provide self-reports and 100% of those patients who were able to respond did so. "That was pretty amazing from our standpoint," Nelson says. "What was disturbing was that the patients were all highly symptomatic. It may be that people are willing to undergo whatever it takes to survive, but they need to understand what's involved in an ICU stay."

Nelson says this was the first systematic study in which patients self-reported their symptoms in real time. "Past research is based on retrospective analyses or interviews that include surrogate perceptions," Nelson says. "The gold standard is the patient's own report."

Undertreating Pain and Overtreating Anxiety?

"We have a lot of patients dying in our ICUs, but dying or not, their comfort has to be the focus of our attention," Nelson says. "Symptom assessment is a step forward in achieving better symptom control. It also provides a baseline for comparing responses to existing symptom management protocols."

Nelson points out that all sorts of detrimental responses are associated with pain, which makes teleological sense. She points to the increased clotting and coagulation associated with pain and injury as an example. When clotting comes from an open wound it makes sense because it prevents dying from hemorrhage. However, clotting and associated pain can also come from catheter insertion during an ICU stay, when Nelson says it can and should be alleviated. "My own feeling is that people will greatly benefit from symptom control," Nelson says. "This study serves as a reminder that ICU patients are still suffering, and this includes patients who are dying."

Thomas Prendergast, MD, critical care physician at Dartmouth-Hitchcock Medical Center in Lebanon, NH, says nurses and physicians often underestimate the amount of pain and discomfort patients are enduring. "We may undertreat pain and overtreat anxiety by giving too few opiates and too many benzodiazipines," Prendergast says.

He points out that ICU physicians tend to underestimate the pain of simple procedures such as endotrachial suctioning, or turning and positioning patients. "Some patient reports suggest that those procedures are very uncomfortable, but we rarely medicate patients for them," Prendergast says. "Maybe there is a balance to be struck between over sedation and appropriate medication for pain."

As support for lowering sedation, Prendergast points to a study in which physicians stopped all sedation of ICU patients until the patient either woke up or appeared uncomfortable. "The result of the intervention was that patients had a much shorter stay on ventilators and under ICU care without an increase in mortality rate," Prendergast says. "We may well prolong their stay on a ventilator by giving so much sedation."

The Mt. Sinai study fuels this argument. Eighty-six percent of the nonresponders were mechanically ventilated as opposed to 62% of responders. The mortality rate was 74% in nonresponders and 36% in those who could respond.

Members of the group who didn't respond and those who did were similar in all characteristics except that mortality was higher among nonresponders. A third of the Mt. Sinai patients died before the end of the ICU study and 55% died before the end of their hospital stay. Many of them were receiving end-of-life care even as they were receiving aggressive treatments to prolong their lives.

No Evidence Supports Need for Pain

Patients don't need to suffer to survive their illnesses, Nelson says. "There isn't any evidence that suffering is required. In fact, there is accumulating evidence that minimizing suffering promotes recovery rather than impeding it."

Nelson acknowledges that when patients are critically ill, concerns about balancing symptom management with the aggressive efforts to prolong life are justified. However, because identifying patients who are dying isn't always possible, she counsels physicians to consider patient comfort first. "What makes the ICU unique and difficult is that you're trying to get patients through a critical illness while making them comfortable because they may not survive it. Good ICU care needs to involve providing comfort both to patients who are pursuing aggressive efforts and for patients who are more clearly at the ends of their lives."

Every patient in the Mt. Sinai study was evaluated by an interdisciplinary palliative care consultation service comprised of an attending physician with palliative care expertise and an advanced practice nurse with palliative care experience who collaborated with the ICU physicians to minimize symptoms. Nelson used a modified version of the Edmonton Symptom Assessment Scale, substituting verbal descriptors for the original instrument's visual analog scale. Patient symptom-reporting choices were none, mild, moderate, or severe.

"We looked at eight symptoms: pain, discomfort, difficulty sleeping, shortness of breath, unsatisfied thirst, unsatisfied hunger, depression, and anxiety," Nelson says. The researchers also asked patients to rate pain and discomfort associated with invasive procedures such as placing feeding tubes or intravenous catheters and the degree of stress they experienced due to limitations on visiting, sleep disruption, inability to communicate, noise, lighting, odor, and temperature. All patients were approached daily for symptom assessment and interviewed about procedures and stress on the fourth day of their ICU stays.

At the moderate or severe rating, 75% experienced discomfort; 71% had unsatisfied thirst; 68% had difficulty sleeping; 63% experienced anxiety; 56% pain; 55% unsatisfied hunger; 39% depression; and 34% shortness of breath. "One can only imagine that, if anything, this is an underestimate at a cross range of institutions," Nelson says. She stresses that the high levels of symptom experience found at Mt. Sinai would not be tolerated in a hospice or other environment in which people are recognized as dying.

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Thirty-six percent of responders died before they left the hospital. "We were able to get at symptoms of non-survivors as well as survivors, something you obviously can't do after transfer from the ICU," Nelson says. "We have documentation from patients who could communicate and were cognitively intact that might serve as evidence for others suffering from similar illnesses and receiving similar treatments under similar conditions, but unable to express themselves." ❖

Reference

1. Nelson J, et al. *Crit Care Med*. 2001;29:277-282.

Defining Futile Care Subject to Misinterpretation

Knowing the Ethical Theory Can Help

By Julie Crawshaw

Compassionate care in the icu accounted for nearly 20% of the papers presented at the 30th International Educational and Scientific Symposium of the Society of Critical Care Medicine in San Francisco last February. As Leslie Mary Whetstine, MA, pointed out in her paper "End-of-Life Care Considerations in the ICU," the problems associated with defining medical futility need to be reviewed in light of the ethical theory behind it in order if the clinician is to make correct and compassionate choices.

"Whetstine says that claiming authentic medical futility is a dangerous and often misused argument at the end of life. Clinicians should "familiarize themselves with the concept of futility, how it affects medical decision making for the patient and family, and what one's obligations are as a clinician when dealing with authentic medical futility."

She describes the ethical theory behind medical futility as having the following components:

- A treatment is considered medically futile and should not be offered if it violates recognized standards of care or will fail in strict physiologic terms to support hemodynamics of metabolism.
- A treatment that is physiologically effective in holding death at bay for a "reasonable" amount of time may not be considered medically futile, even if the time involved is a matter of hours or days

instead of months and years.

- Clinicians should consider the quality of life that results from the treatment. The patient's conception of his or her own quality of life is authoritative and staff members cannot unilaterally decide what quality of life is or is not acceptable for an individual, even though most people do not choose medical interventions that would severely compromise their quality of life.
- A treatment with an extremely low probability of success may be considered futile, though this consideration does not carry as much weight as the components above.

Because courts and many medical ethicists have tended to favor the first two definitions, Whetstine says that clinicians are well advised to do so also until legal clarification becomes available. "Making a strong case for futility is difficult under current social, political, and legal traditions, and until the criteria and the public consensus change, this argument may not be one that will be useful but for a handful of instances. Invoking futility is often a lose-lose argument that may alienate the clinician further from the family when, in the end, it is likely that the clinician will have to abandon that position, with many relationships having suffered," she says.

Robert Burt, JD, of Yale Law School observes that "when consensus has failed, the futility argument is raised at the bedside." As an example, the legal history of futility, Burt cites the case of Baby K, an anencephalic baby brought to a Virginia emergency room. The parents wanted physicians to intubate and ventilate their baby and the courts ordered physicians to comply, even though the physicians believed the interventions were medically futile.

Burt observes that courts usually order the treatment that families request because they don't want to be involved in patient death. However, judges and juries have historically been reluctant to punish physicians who withdraw therapy.

Could Intensivists Save Thousands of Lives?

Physicians specializing in intensive care could save thousands of lives each year if only hospitals would hire more of them for ICUs, according to a presentation at the recent meeting of the Society of Critical Care Medicine in San Francisco.

John Hoyt, MD, an intensivist at St. Francis Hospital in Pittsburgh and chair of the new foundation, announced the group would be spearheading an effort to change the way ICUs are organized. Only one out of seven of the 5000 ICUs in the United States are led by an intensivist, he says.

Intensivists gained more attention when the Leapfrog Group, a California consortium of health care purchasers, called for more of them as a way to improve patient safety. The Leapfrog Group has estimated that some 58,000 lives could be saved annually by staffing ICUs with specialists, computerizing the filling of prescriptions, and referring complex operations to high-volume medical centers.

Most hospitals, 85%, employ a full-time intensive care nurse to run the unit, he says, with physicians in each specialty treating individual patients. But Hoyt says recent studies indicate patient care can be improved by employing a specialized intensive care team led by a full-time physician, and including a dedicated intensive care nurse, pharmacist, and respiratory therapist. That dedicated team can also reduce errors and decrease deaths, he says.

Hoyt says the group wants to increase the number of ICUs led by an intensivist to 50% in the next five years. The group plans to raise $1.5 million to educate the public about the need for intensivists, conduct research into the improved safety of having an intensive care team, and convince medical professionals to train for this specialty. ❖

Leapfrog Group Outlines What is Acceptable

Says More ICU Staffing Could Save Lives

The leapfrog group's research suggests that its health care initiatives could radically reduce medical errors in the United States if only health care providers would implement them expeditiously. And to encourage their implementation, the group has outlined exactly what it would consider acceptable action by providers.

To compile statistical measures on how effective the changes might be, the group used the same basic analysis strategy for each of the three safety standards. Researchers first estimated the population at risk—the number of patients who are currently receiving care in suboptimal conditions and, thus, stand to benefit from changes imposed by Leapfrog. To avoid access issues and other unintended consequences, The Leapfrog Group exempted hospitals in rural areas. Thus, the population at risk is restricted to patients in metropolitan areas.

Then the group estimated baseline risks (of medication errors or mortality) in hospitalized patients, and the potential risk reductions associated with each of the safety standards. This is a summary of the potential benefit from full implementation of the three initiatives and how The Leapfrog Group expects providers to comply with the following guidelines.

Computer-based Physician Order Entry

The group estimates that implementation of computer-based physician order entry (CPOE) in every nonrural hospital in the United States would avert approximately 522,000 serious medication errors each year. Because of the relatively few studies in this area, the analysis relied on two well-recognized trials from a single teaching hospital. The Leapfrog Group acknowledges that some may question the validity of generalizing these data to other hospitals nationwide.

"However, we chose the most conservative estimate of CPOE effectiveness [55% medication error reduction rate] for our baseline analysis," the group reports. "Although a large proportion of serious medical errors is life-threatening, the number that result in fatalities cannot be determined precisely from the medical literature. Accordingly, we did not calculate the number of deaths potentially avoided by CPOE. However, if only 0.1% of such errors were fatal, over 500 deaths would be avoided every year. If the fatality rate were 1%, over 5000 deaths would be avoided."

CPOE systems are electronic prescribing systems that intercept errors when they most commonly occur—at the time medications are ordered. With CPOE, physicians enter orders into a computer, rather than on paper. Orders are integrated with patient information, including laboratory and prescription data. The order is then automatically checked for potential errors or problems. The Leapfrog Group says the specific benefits of CPOE include prompts that warn against the possibility of drug interaction, allergy, or overdose; accurate, up-to-date information that helps physicians keep up with new drugs as they are introduced into the market; drug-specific information that eliminates confusion from drug names that sound alike; improved communication between physicians and pharmacies; reduced health care costs from improved efficiency.

In order to meet Leapfrog's CPOE standard, hospitals:

1. Require physicians to enter medication orders via computer linked to prescribing error-prevention software.
2. Demonstrate that their CPOE system intercepted at least 50% of common serious prescribing errors, using a testing protocol specified by First Consulting Group and the Institute for Safe Medication Practices.
3. Require documented acknowledgment that the physician read the directives to any override.

Despite the considerable benefits, The Leapfrog Group says fewer than 2% of U.S. hospitals have CPOE completely or partially available and require its use by physicians. The upfront cost of implementing CPOE is one major obstacle for hospitals. At Brigham and Women's Hospital in Boston, the cost of developing and implementing CPOE was approximately $1.9 million, with $500,000 maintenance costs per year since. Installation of even off-the-shelf CPOE packages requires a significant amount of customization for each hospital and can be very expensive. Finally, there may be cultural obstacles to CPOE implementation. For example, many physicians resist the idea of ordering prescriptions via computer instead of by hand.

ICU Physician Staffing (IPS)—53,850 Lives Saved

The Leapfrog Group maintains that IPS is so effective because such a large number of people die in ICUs each year (approximately one-half million). Thus, even small improvements in ICU mortality rates save many lives.

The group acknowledges that although work force issues have not been studied carefully, it is unlikely that there are currently enough board-certified intensivists to fully staff ICUs at all hospitals. And the group says that in hospitals with small units, meeting the Leapfrog daytime intensivist staffing standard may increase net cost per stay. "For these reasons, broad implementation of intensivist model ICU staffing may require a mixture of increased fellowship training slots in critical care, consolidation of small ICUs, and advances in ICU telemedicine."

Evidence-based Hospital Referral (EHR)—A Total of 2581 Lives Saved in 5 High-risk Procedures; 1863 Lives Saved in High-risk Deliveries

The Leapfrog Group says the greatest number of deaths would be prevented by evidence-based hospital referrals for coronary artery bypass graft surgery (1486 deaths), followed by elective abdominal aortic aneurysm repair (464 deaths), and coronary angioplasty (345 deaths). Potential lives saved with esophagectomy and carotid endarterectomy were 168 and 118, respectively. The analysis estimates the benefits that could be achieved with full adherence to Leapfrog volume standards in all U.S. metropolitan hospitals. The other two Leapfrog safety initiatives—CPOE and IPS—involve all-or-none hospital interventions. Making these changes for Leapfrog employees implies their availability to all other patients at the same hospitals. In contrast, even if EHR could be increased for Leapfrog employees, there would be no mechanism for assuring the same change in referral pattern for other patients.

"For this reason, a very important contribution of the Leapfrog safety initiative may occur by simply increasing public awareness of the importance of volume for selected high-risk procedures," the group says.

For high-risk neonatal intensive care, full implementation of EHR for high-risk deliveries would save 1863 babies' lives each year in the United States. ❖

Antibiotics Anonymous Redux*

By Stan Deresinski, MD, FACP, Editor, Infectious Disease Alert

Are *You* Antibiotic Dependent?

- ❑ Do you prescribe antibiotics to relieve tension?
- ❑ Do you prescribe antibiotics more than other physicians but are able to hide it?
- ❑ Do you sometimes feel guilty about the way you prescribe antibiotics?
- ❑ Do you have a strong urge to prescribe antibiotics at a particular time of day?
- ❑ Have you lost ambition since you began prescribing antibiotics in this way?
- ❑ Has another physician advised you to stop or cut down your prescribing?
- ❑ Are you harder to get along with when you are heavily prescribing?
- ❑ Have you ever tried to cut back?
- ❑ Do you have difficulty sleeping a full night?
- ❑ Have you ever been in trouble with the antibiotic police?
- ❑ Have you ever done anything while prescribing that you don't remember (have a blackout)?
- ❑ Have you ever promised yourself you would cut back on your prescribing and then broken that promise?
- ❑ Have you ever tried to convince people that you were not prescribing antibiotics when you were?
- ❑ Do you wish people would mind their own business about your antibiotic prescribing—that they stop telling you what to do?
- ❑ Have you ever switched from one kind of antibiotic to another in the hope that this would keep you from going over the edge?
- ❑ Have you had to have an eye-opener (ie, prescribed an antibiotic immediately upon awakening, in the last year)?
- ❑ Do you envy people who can prescribe antibiotics without getting into trouble?

For those who have answered yes to one or more of these questions, I have begun the development of a 12-step program. Unfortunately, I have only been able to develop half of a 12-step program.

- ❑ You must admit that you are powerless over your antibiotic prescribing.
- ❑ You must believe that a power (an antibiotic guru) greater than yourself can restore you to sanity.
- ❑ You must make a decision to turn your will and life over to the care of that power.
- ❑ You must make a searching and fearless moral inventory of yourself.
- ❑ You must admit to the power and to yourself the exact nature of your misprescribing.
- ❑ You must humbly ask the power to remove your antibiotic shortcomings.

* *Lockwood WR. Letter: Antibiotics anonymous. N Engl J Med 1974;290:465-466.*