CRITICAL CARE MEDICINE

Vol. 21, No. 10
Printed in U.S.A.

No headlines, just headway

Without a doubt, it is always a joy to read a paper that confirms one's own bias or experience. The paper by Roberts et al. (1) not only falls into this category but surpasses our prior publication (2) in important ways. I don't know what stimulated the Winnipeg group, but I would like to relate what prompted our investigations.

In 1983, we were intrigued by an ultrasonic device that measured hourly urinary output. Our hospital, already under severe financial restraints, required that new technology be supported by cost-related data. The principal concern was that the calibrated urine collection device was much more expensive than the urine meters with a small graduated container included for hourly collections. I had noted that Foley catheter kits usually had a large drainage bag attached. If hourly urinary output measurements were necessary in the operating room or intensive care unit (ICU), this drainage bag was discarded and the urine meter was substituted. After discharge from the ICU, this device was discarded because nurses in routine care areas seem to prefer the large drainage bag. Therefore, we wished to see if this observation, that three separate collection bags were used during the period of catheterization, was true and if the costs of these three together were more than the single device that could be used in all three locales (it is placed in the ultrasonic measurement device when hourly outputs are desired). It seemed simple enough to request the itemized bills for 50 consecutive patients admitted to our ICU and then to count up the number of urine collection devices charged to each patient. Parenthetically, this hypothesis proved to be true and we used this "study" as an example of how high technology and high cost need not be synonymous and that a high-tech device might actually ease the nurses' work, simplify data collection, and save money (3).

When the 50 bills were delivered to our office, we thought there had been some mistake, because there was a stack of computer printouts nearly 3 feet tall. We wondered what could possibly fill so much paper. The answer became obvious as soon as we started perusing the bills. Page after page of printouts were charges for laboratory tests. It didn't take very long to discern that the dates of the charges coincided with the dates that the patient spent in the ICU. After completing our tabulations of the urinary collection devices, we selected about 25 of the most common laboratory tests and counted the frequency in each patient's bill. Parenthetically, again, when I say we, the majority of this intense manual effort was performed by my research associate, Judith A. Hudson-Civetta. We were astounded to learn that the daily practices in our unit had resulted in an average of 23 tests per patient per day. We could not help but believe that some control was possible, and together with the nursing staff, respiratory therapists, fellows, and attending physicians, we analyzed our behavior and developed ten control measures. It took some time to implement and refine them, and particularly to reinforce our belief that they should be followed. Implementation of new measures is particularly difficult in ICUs in teaching hospitals, where much of the ordering is done by residents and students who have such short rotations that there is a constant change in the personnel involved. However, we were able to document a 42% decrease in overall testing associated with a 53% decrease in ICU laboratory charges 6 months after the interventions had been introduced. In the discussion portion of our article (2) we stated, "We wonder if similar practices exist in other busy intensive care units where their particular habits, traditions, and bedside practices, result in many laboratory determinations."

Seven years later when I received the current manuscript (1), I was pleased to find that the same recognition and approach evolved independently in a different medical system and yet had the same results. In their words, "We hypothesized that a cost-effective, practical management approach could be employed in adult medical and surgical ICUs to reduce the frequency of diagnostic laboratory testing in a sustainable manner, and that this would result in cost savings." As I mentioned at the beginning of this editorial, their study goes far beyond ours in important ways. They used computer-based information systems, created monthly reports, and continued to monitor for 2 yrs after the interventions had been introduced. This approach is particularly important since many previous studies have shown that reductions in utilization can occur during the period of scrutiny, but, unfortunately, frequencies returned to prior levels as soon as administrative attention was removed. The authors also incorporated data concerning severity of illness, duration of stay, mortality rate, drug costs, and therapeutic

Key Words: cost control; cost savings; computers; computer systems; caregivers; hospital laboratories; patient care management; patient care team; blood gas analysis; blood glucose
0090-3493/93/2110-1416$03.00/0

interventions to document that these interventions were both safe and effective.

Of particular interest to me was the type of interventions that they introduced. They discovered that ward clerks checked off osmolalities each time electrolytes were ordered, so they changed the form to exclude osmolality. Differential white blood cell counts were done far too frequently in their institution as in ours, so they ignored orders if the white blood cell counts were normal. Like most ICUs, potassium and glucose determinations are done frequently. Insulin and potassium infusions are probably the most common bedside activities, which of course means that one must repeat the potassium/glucose determinations to see what effect the prior intervention has had. They substituted a glucometer and specific policies to decrease the unregulated activities that resulted in glucose and potassium testing. They found that chest radiographs and electrocardiograms were performed without clear indications. We discovered that, somehow in the distant past, our standing orders stated that an electrocardiogram should be performed on admission—another order without clear indications. In fact, we finally decided to eliminate standing orders for laboratory testing to encourage individualized physician-processed ordering. One of my favorite sayings became: "Thinking, not screening, detects rare abnormalities." Finally, they attacked blood gases, frequently identified (4) as the most common ICU laboratory test. They then developed a detailed algorithm, because they noted that arterial and mixed venous blood gas samples were routinely sent, even in stable patients. In fact, when we tried to identify exactly why most of our blood samples for blood gases were sent, it was impossible to do so. Our phrase to describe that phenomenon was, "blood leaked down to the laboratory," i.e., no one acknowledged sending the sample. We did recognize that just before report, whether morning physician rounds, or change of nursing shifts, blood samples were sent for determination of blood gases on seemingly every patient so that one would have "hot new data" to include in the report. We also realized, after initially controlling utilization through seven of the ten ways that we introduced, that both pulse oximetry and mixed venous oximetry could be used to substitute for almost all the individual blood gas determinations (5), and reduced usage even further.

Each aspect of the commitment required that is described by the Winnipeg group is important. That they have devised a management approach based on a computer database should serve as an example to all of us. The time-consuming manual process we used provided us with a stimulus to intervene but was only used in a few patients in two time periods. Today, many ICUs have patient data management systems or at least microprocessor-based information systems. I again exhort the Society of Critical Care Medicine membership (6) to lead in this area: look around and you too will be astonished at what you will find. I also exhort the major monitoring companies and individual programmers to design either modules for existing systems or to write software for the IBM and Macintosh worlds to capture laboratory frequency data.

What of the impact? If Roberts et al. could achieve cost savings of $150,000 Canadian dollars per year, and there are 8,000 ICUs in the United States alone, then one may wildly extrapolate to $1.2 billion of easily obtained cost savings. I still believe as they do that their unit was not particularly inefficient and that these opportunities exist everywhere. Stern and Epstein (7), in my estimation, identified these opportunities as "Physician practice style:" how tests are generated, the reasons cited for initiating testing, the validity of the reasons, and the factors responsible for repetitive testing. But it is more than mere cost savings. We all should be encouraged to decrease testing because of Robin's description of the four types of harm (8) that occur as a result of unnecessary measurements. They all would be diminished by the elimination of unnecessary testing: a) technical errors that are reported as erroneous laboratory results, which then lead to incorrect decisions; b) iatrodemics, interpretive errors that are based on correct information but which lead to incorrect decisions; c) injuries to patients from invasive procedures elected because of interpretive errors; and probably the most important, d) informational overload that prevents proper prioritization. Thus, diminished laboratory testing can have salutary effects. Physicians and nurses can return to assessment, decision-making, and spend more time with patients and families.

Finally, let us consider Fuch's often quoted request to physicians (9), "Consider the possibility of contributing more by doing less." In order to contribute more, we need to achieve a greater understanding of the bedside process of care that leads to the generation of all this unnecessary testing. Only after this individualized effort, unit by unit, can "doing less" be achieved and validated. We can learn to distinguish the necessary and costly elements from utilization and overload, to simplify bedside care, to have time for caring functions—and we can still save money. The headlines today are reserved for macro changes in the environment of medical costs. Continuous quality improvement, managed competition, and many other phrases grab the headlines. Roberts and his colleagues, in my opinion, have made an extraordinarily important contribution because, while the experts opine, money is wasted in dribs and drabs at the bedside. Once again,

"an information-based multidisciplinary management team can produce marked and sustained reductions in unnecessary testing in a cost-effective manner" (1). Let the Society of Critical Care Medicine follow this advice, make a real contribution to cost savings, and gain attention as an authoritative source of information concerning health costs in critical care.

Joseph M. Civetta, MD
University of Miami
School of Medicine
Miami, FL

REFERENCES

1. Roberts DE, Bell DD, Ostryzniuk T, et al: Eliminating needless testing in intensive care—An information-based team management approach. *Crit Care Med* 1993; 21:1452–1458
2. Civetta JM, Hudson-Civetta JA: Maintaining quality of care while reducing charges in the ICU. *Ann Surg* 1985; 202:524–532
3. Civetta JM, Hudson-Civetta JA: Cost-Effective Use of the ICU in Cost Effectiveness in Surgery. Eiseman B (Ed). Philadelphia, WB Saunders, 1987, pp 13–33
4. Drucker WR, Gavett JW, Kirshner R, et al: Toward strategies for cost containment in surgical patients. *Ann Surg* 1983; 198:284–297
5. Civetta JM: Bedside Use of Arterial and Venous Oximetry in Critical Care. Second Edition. Civetta JM, Kirby RR, Taylor RW (Eds). Philadelphia, JB Lippincott, 1992, pp 313–324
6. Civetta JM: Critical care: How should we evaluate our progress? *Crit Care Med* 1992; 20:1714–1720
7. Stern RS, Epstein AM: Institutional responses to prospective payment based on diagnosis related groups: Implications for cost, quality, and access. *N Engl J Med* 1985; 312:621–627
8. Robin ED: A critical look at critical care. *Crit Care Med* 1983; 11:144–147
9. Fuchs VR: A more effective, efficient, and equitable system. *West J Med* 1976; 125:3–5

Selective digestive decontamination in critically ill patients

Nosocomial infections contribute to the morbidity and mortality of hospitalized patients (1). Bladder drainage devices, endotracheal tubes, and intravascular catheters all increase the likelihood of colonization and subsequent infection of patients. Colonization of the oropharnyx and tracheobronchial tree with Gram-negative aerobic bacilli occurs rapidly in both intubated and unintubated critically ill patients (2–5), although colonization with *Staphylococcal* species, enterococci, and yeast have become more common. Since both endotoxin absorption from the gastrointestinal tract and bacterial translocation may be responsible for the development of the multiple organ dysfunction syndrome (6–8), therapy directed at reducing the number of aerobic Gram-negative bacilli is intellectually appealing.

Potential beneficial effects of selective digestive decontamination in critically ill patients could include: decreased colonization by potential pathogens, decreased frequency of infections, decreased frequency of multiple organ dysfunction syndrome, decreased overall antibiotic costs, reduced length of stay, and reduced mortality rates. Potential disadvantages of selective digestive decontamination include: drug toxicity, emergence of resistance organisms, increased antibiotic cost, and an unanticipated deleterious effect on patient survival. Furthermore, certain subsets of critically ill patients (e.g., trauma, burn, neutropenic, postoperative) may not equally benefit from selective digestive decontamination. Before discussing clinically relevant outcomes, it is important to understand the possible limitations of the more than 20 studies using selective digestive decontamination.

Last year, *Critical Care Medicine* published a comprehensive review (9) of selective digestive decontamination studies through the end of 1990, accompanied by an editorial on the subject (10). Most studies have used an orally administered antifungal agent (amphotericin B or nystatin) combined with two orally administered, nonabsorbable antibiotics. Pharmacy cost for treatment with 1 g/day of amphotericin is $320.00/day compared with one million units/day of nystatin for $0.96/day. Controlled trials directly comparing these two agents have not been performed. The most common antibiotic combination, and the one used in the initial study of selective digestive decontamination in trauma patients (11), is tobramycin and polymyxin E. Recent studies have used norfloxacin alone (12) or substituted neomycin for tobramycin (13). The clinical significance

Address requests for reprints to: Michael R. Silver, MD, Section of Pulmonary and Critical Care Medicine, Department of Medicine, Rush-Presbyterian-St. Luke' Medical Center, 1653 W. Congress Parkway, Chicago, IL 60612.

Key Words: nosocomial infections; tobramycin; polymyxin E; amphotericin B; drug costs; digestive decontamination; critical illness; bacteria