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Comforting the Patient Speeds Nasogastric Tube Insertion

ABSTRACT & COMMENTARY

Numerous invasive and discomforting procedures are performed almost routinely in the critical care setting. Clinicians are advised to use comforting strategies during such procedures. However, little is known about how such strategies impact clinician effectiveness or efficiency. To evaluate the effect of clinician approach, Morse and colleagues analyzed 32 cases of nasogastric (NG) tube insertion that occurred during trauma care in conscious patients. The cases were identified from a review of 193 trauma cases videotaped in three Level 1 trauma centers (among which 32 involved NG tube insertion in conscious patients). The 49 clinicians inserting NG tubes included nurses (55%), physicians (37%), and students (8%).

Insertion attempts in each patient ranged from 1-5. To categorize clinician behavior, Morse et al viewed the videotapes, defined patterns of behavior, and developed codes that reliably categorized these behaviors (> 80% agreement among multiple raters). The categories were: 1) technical (priority given to procedure, limited communication with patient beyond commands); 2) affective (priority given to minimizing patient discomfort); 3) blended (primary focus on procedure but attentive to patient comfort); and 4) mixed (several different approaches).

Most (53%) clinicians used the technical approach and interacted minimally with the patient except to give instructions. Mean total time for NG tube insertion, sorted by approach used on the last trial, was: technical 108.1 ± 12.8 seconds, affective 70.1 ± 53.0 seconds, mixed 61.4 ± 23.6 seconds, and blended 53.0 ± 17.6 seconds. Clinicians who used the technical approach on the first trial took more time to complete the task than clinicians who used the blended approach, for both the subsample of successful insertions (P = 0.009) and the full sample (P = 0.022). Clinicians who used the technical approach on the last trial fared similarly. They required more time to complete the task, both overall (P = 0.05), and when the number of trials was controlled for by analysis of covariance (P = 0.03), compared to the blended group. (Morse JK, et al. *Am J Crit Care* 2000;9:325-333.)

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INSIDE

COMMENT BY LESLIE A. HOFFMAN, PhD, RN

This study used an innovative approach to document, define, and categorize behavioral styles of providing care and differences in the effectiveness of these behavioral styles. The technique used to record clinician behavior was unobtrusive. Video cameras were mounted on the walls of trauma rooms and taping was done on a continuous basis throughout the patient's treatment. Operators and monitors were not present in the room. Four patterns of clinician behavior toward the patient during the procedure were identified. Overall, clinicians who balanced the technical aspects of the procedure with use of comforting strategies (blended approach) were the most efficient and most effective in completing the procedure. Clinicians who were most attentive to procedural technique with little respect to the patient's discomfort (technical approach) or were overly attentive to comforting strategies (affective approach) took longer and/or were less successful in completing the procedure.

This study is one of the first to provide objective documentation of the value of comforting strategies during invasive procedures in critically ill patients. As such, study findings provide strong support for a need to balance technologic expertise with actions that consider patient needs. We are frequently reminded of the importance of comforting strategies. However, it is easy to omit such strategies in the fast paced critical care environment. Findings of this study provide strong support for including such actions, as a means to increase patient comfort and, thereby, the efficiency and effectiveness of care. ❖

Critical Care Alert, ISSN 1067-9502, is published monthly by American Health Consultants, 3525 Piedmont Rd., NE, Bldg. 6, Suite 400, Atlanta, GA 30305.

VICE PRESIDENT/GROUP PUBLISHER: Donald R. Johnston.

EDITORIAL GROUP HEAD: Glen Harris.

ASSOCIATE MANAGING EDITOR: Robin Mason.

ASSISTANT MANAGING EDITOR: Neill Larmore.

COPY EDITOR: Melissa Lafferty.

MARKETING PRODUCT MANAGER: Schandale Kornegay.

GST Registration Number: R128870672.

Periodical postage rate paid at Atlanta, GA.

POSTMASTER: Send address changes to *Critical Care Alert,* P.O. Box 740059, Atlanta, GA 30374.

Back issues: $33.

Missing issues will be fulfilled by customer service free of charge when contacted within one month of the missing issues date.

AMERICAN HEALTH CONSULTANTS ™
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Customer Service E-Mail Address: customerservice@ahcpub.com

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

World Wide Web: http://www.ahcpub.com

Subscription Prices

United States

$249 per year. (Student/Resident rate: $100)

Multiple Copies

1-9 additional copies: $179 each; 10 or more copies: $159 each.

Canada

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Statement of Financial Disclosure

In order to reveal any potential bias in this publication, and in accordance with Accreditation Council for Continuing Medical Education guidelines, we disclose that Dr. Pierson serves on the speaker's bureau at Glaxo-Wellcome. Dr. Durbin and Dr. Hoffman report no consultant, stockholder, speaker's bureau, research, or other financial relationships with companies having ties to this field of study.

Nitric Oxide as a 'NOvel' Therapy for Gastrointestinal Ulcers?

ABSTRACT & COMMENTARY

Synopsis: *Drugs that release nitric oxide have been shown to prevent ulcers and accelerate ulcer healing in animals. This large, case-control study demonstrates that oral or transdermal nitrosovasodilators are independently associated with a reduced risk of upper gastrointestinal bleeding.*

Source: Lanas A, et al. *N Engl J Med* 2000;343: 834-839.

Lanas and colleagues studied the relationship between medications that release nitric oxide (oral or transdermal preparations of nitroglycerin), medications that promote ulcers (low-dose aspirin, high-dose aspirin, and other nonsteroidal anti-inflammatory drugs), anti-acid agents (H_2 receptor antagonists and omeprazole), and the risk for developing upper gastrointestinal (GI) bleeding. They performed a case-control study of 1122 consecutive patients admitted with upper GI bleeding to one of four general hospitals in Spain. The 2231-patient control group consisted of 1109 patients hospitalized for other reasons and 1122 outpatients from the same region. Control subjects were chosen to achieve frequency matching with the patients according to sex and age.

As expected, the use of nonsteroidal anti-inflammatory drugs (NSAIDS) was associated with an increased risk of bleeding (odds ratio, 7.4 for NSAIDS other than low-dose aspirin and 2.4 for low-dose aspirin), and anti-secretory therapy was protective (odds ratio, 0.6). Omeprazole, a proton-pump inhibitor, was more effective than H_2-receptor antagonists. Interestingly, the use of nitrosovasodilators was protective as well, with an odds ratio of 0.6 and a 95% confidence interval of 0.4 to 0.8. Despite the anti-platelet effects of nitric oxide, nitrosovasodilators appeared to prevent GI bleeding.

COMMENT BY MARK T. GLADWIN, MD

Nitric oxide is a free-radical gas molecule produced endogenously by the nitric oxide synthase enzyme systems, and plays a critical role in the regulation of blood flow, immune function, and cellular signal transduction. Recent data suggest that nitric oxide increases gastric mucosal blood flow and inhibits leukocyte adherence to the GI microvasculature. These properties result in reduction in ulcerogenesis and improvement in ulcer healing in rats treated with oral or intravenous nitroglycerin. A nitric oxide-releasing aspirin product has even been developed to reduce ulcer formation. Critically ill patients are highly susceptible to gastric and duodenal erosion, ulceration, and bleeding, particularly in the presence of coagulopathy and the need for mechanical ventilation. While anti-secretory therapies are protective, they increase the risk of nosocomial pneumonia, and break through bleeding is common. For these reasons, new therapies to reduce the incidence of GI bleeding in the ICU are needed. These data suggest that nitric oxide releasing compounds, taken orally or transdermally—and thus suggesting that intravenous therapy would be effective—reduce the clinical risk of GI hemorrhage. Studies in ICU patients at risk for such bleeding should be undertaken in order to determine whether nitroglycerin preparations should be administered daily, enterally or transdermally, to mechanically ventilated ICU patients. Will these therapies be effective in this population and will they demonstrate additive or synergistic effects with antisecretory therapy? ❖

Effect of Infection on Outcome in Acute Pancreatitis

ABSTRACT & COMMENTARY

Synopsis: *Demonstration of pancreatic necrosis by computed tomography identifies a subgroup of patients with the most severe form of acute pancreatitis. Among patients with necrotizing pancreatitis, this study found that the presence of infection in the pancreatic bed increased the overall mortality rate several-fold.*

Source: Buchler MW, et al. *Ann Surg* 2000;232(5): 619-626.

Infection of the necrotic tissue, likely secondary to bacterial translocation from the colon, is a complication associated with a marked increase in mortality, according to most series, and may represent an indication for surgical debridement of the pancreas and retroperitoneal tissues. In a prospective cohort, Buchler and colleagues describe their treatment approach for acute pancreatitis, which relies heavily upon surgical therapy when infected pancreatic necrosis is diagnosed.

Buchler et al describe a series of 204 patients with acute pancreatitis admitted to their hospital in Berne, Switzerland, between January 1994 and June 1999. Of these patients, 86 were found to have acute necrotizing pancreatitis (ANP), based upon CT scan findings. By various indices (Apache II, Ranson's criteria), these 86 patients had more severe systemic disease than the 188 patients with pancreatitis without necrosis. They had a longer hospital stay (44 days vs 13 days) and a higher mortality (10% vs 0%). Twenty-nine (34%) were diagnosed with infected pancreatic necrosis, based upon fine needle aspiration in 28 and post-mortem examination in one patient (despite 3 sterile, fine-needle aspirates in this patient prior to death).

Additional details of Buchler et al's therapeutic strategy are presented in the manuscript, but this summary addresses where surgery fits into their treatment armamentarium. The treatment protocol involved surgical decision-making, based primarily upon the results of percutaneous (CT-guided) fine-needle aspiration and culture of the necrotic pancreatic tissue. Growth of organisms mandated surgery, which included resection of necrotic pancreas, followed by post-operative continuous lavage.

In patients with infected necrosis, the case-fatality rate was 24%, compared to 3.5% for patients with presumed sterile necrosis. One of the patients presumed to have sterile necrosis died and was found to have infected necrosis at autopsy. Therefore, 27 of 28 patients (96%) with infected necrosis were diagnosed on the basis of fine-needle aspiration and culture. One of 16 patients with culture-negative fine-needle aspirates was found to have infected necrosis at autopsy. The remaining 15 patients with culture-negative aspirates lived and did not appear to have pancreatic infection based upon clinical recovery. However, we cannot be certain that infection was absent, and simply responded to conservative (intravenous antibiotic) management. Similarly, the remaining 41 patients considered to have sterile pancreatic necrosis did not undergo fine-needle aspiration, and therefore the true status of the pancreas was unknown in these individuals. One of these patients died from progressive organ

failure and was found to have sterile necrosis at autopsy.

COMMENT BY GRANT E. O'KEEFE, MD

Acute pancreatitis is most often a mild-to-moderate and self-limited disease that requires supportive therapy and subsequent treatment of the underlying cause (cholecystectomy for biliary lithiasis, etc). However, severe inflammation may lead to necrosis of the pancreas and adjacent retroperitoneal tissues, local infection, and the systemic complications of multiple organ dysfunction (MOD). The combination of clinical and radiological (computed tomographic) criteria identifies the majority of patients with severe acute pancreatitis. The demonstration of pancreatic necrosis by CT identifies a subgroup of patients with the severest form (ANP); patients who present a great therapeutic challenge and represent the majority of fatalities. Numerous therapeutic interventions have been tried and various treatment guidelines proposed, but there are few compelling data upon which to base recommendations.

Surgery has been considered an important component in the treatment of ANP, although the indications and timing of operative therapy are controversial. Early surgical intervention, including debridement of necrotic tissue has been considered by some to be an important component of treatment. However, surgery is not without complications, and the benefits are not clear or widely accepted.

The findings of this study support the concept of a detrimental effect of infected pancreatic necrosis upon outcome, and the potential use of fine-needle aspiration in directing surgical management. However, there are a number of major limitations that physicians and surgeons caring for these patients must consider. We have no knowledge of the infection status of the 41 patients who did not undergo fine-needle aspiration. Therefore, we must consider that at least some of these patients had infections, which responded to antibiotic therapy and resolved without surgery. We also know that one patient died from the ravages of severe, ongoing systemic inflammation and organ failure despite having "only" sterile necrosis.

It is also critical to note that 12 of the 28 patients underwent more than one fine-needle aspiration. Therefore, only 16 (57%) of the initial aspirates were positive, suggesting that the actual sensitivity may be much lower than the reported 96%. Patients with an ultimately positive FNA and with positive intraoperative cultures had a 24% case-fatality rate. As we do not have a comparison group, with known infected necrosis, it is not certain whether surgery effects the course of ANP once infection is established. Conversely, we cannot be certain that waiting for the diagnosis of infected necrosis before considering operative therapy can be universally applied. Would earlier surgery avert the progression to infection and the systemic complications?

This study raises many of the important issues faced when caring for these complicated, critically ill patients, in whom surgery must be considered in the context of the other supportive therapies. While not definitively answering the questions of: 1) who requires surgery; 2) when should surgery be done; and 3) what procedure should be used, this study provides a rational framework for the consideration of these questions in the management of patients with acute necrotizing pancreatitis. ❖

Does Algorithm-Guided Care Have an Adverse Effect on House Staff Knowledge?

ABSTRACT & COMMENTARY

Synopsis: *Use of a respiratory therapy consult service in which respiratory therapists determine patients' respiratory care plans based on algorithms did not affect house officer's expertise in respiratory care management.*

Source: Stoller JK, et al. *Respir Care* 2000;45: 945-952.

Respiratory therapy "evaluate and implement" protocols have been advocated as a means of increasing the appropriateness of respiratory care prescribing, while decreasing costs and averting morbidity. Although studies indicate that explicit algorithms and/or care plan guidelines positively impact the use of respiratory care services (RTCS), concern has been expressed that the use of such protocols may negatively impact medical trainees' education.

To determine if a RTCS detracted from internal medicine house officers' knowledge of respiratory care ordering, Stoller and colleagues tested trainees in two academic teaching hospitals, one with and one without a RTCS. Each trainee was asked to review five case studies consisting of a brief clinical vignette accompanied by four multiple choice questions about the type of respiratory care treatment indicated. To avoid institutional bias, cases were prepared by practitioners at both institutions. The case studies were distributed at a scheduled meeting

of internal medicine house staff after a verbal explanation of the study. Of those eligible, 57 (33%) completed the case studies, including 25 interns, 17 junior residents, and 15 senior residents. There was no difference in the overall scores for trainees where a RTCS was used or was not used, 77.2% ± 11.6% vs. 75.8% ± 12.0%, respectively (P = 0.69). Between group comparisons of answers on each case study showed a significant difference for one case study. House officers at the institution with a RTCS achieved a higher score (86.6% ± 18% vs 69.1% ± 14%, P = 0001), a difference that persisted after adjusting for year of postgraduate training.

COMMENT BY LESLIE A. HOFFMAN, PhD, RN

The main finding of this study was that internal medicine house officers' knowledge of respiratory care ordering, as assessed by responses to case studies, was similar among trainees at a teaching hospital in which use of respiratory care protocols was longstanding and trainees at a teaching hospital where such protocols were not in use. The overall rate of correct responses was similar and there was no indication that house officer's years of postgraduate training confounded the results.

Although the use of various types of guidelines (algorithms, protocols, care pathways) holds great promise, their ultimate value is determined by the effect they have on patient care, including their effect on the quality of care, patient satisfaction, and costs. Over the past 10 years many studies have evaluated the effect of guidelines on patient care. In a recent review, 55 of 59 guideline studies demonstrated at least one beneficial change in the process of care and nine of 11 studies that examined patient outcomes showed improved care.[1] Thus, published evidence strongly supports the assertion that guidelines can improve care. Nevertheless, many clinicians resist using this approach.

In this paper, Stoller et al address a specific concern with the use of guidelines—they may detract of the education and experience of house officers in academic teaching institutions. Their study's findings demonstrated no discernable effect. As acknowledged by Stoller et al, there are several limitations to this study. Only two institutions were involved. Responses were elicited from only a minority (33%) of house officers and there is no way to determine impact at the bedside. Subject to these interpretive cautions, findings of this study provide initial support for the premise that use of a RTCS does not affect house officer knowledge and strengthens the rationale for use of such protocols. ❖

Reference

1. Weingarten S. *Chest* 2000;118:4S-7S.

Special Feature

End Points in Shock Resuscitation: Current Concepts

By Karen Johnson, PhD, RN, CCRN

The issue of end points in resuscitation in the critically injured patient is one of the greatest sources of confusion and controversies in trauma care.[1] What constitutes adequate resuscitation? What clinical parameters can be used to determine adequacy of shock resuscitation? The initial step in managing shock in the injured patient is to recognize its presence. According to Advanced Trauma Life Support, the diagnosis is based on clinical appreciation of the presence of inadequate organ perfusion and tissue oxygenation.[2] This provides us with a good working definition because it contains the end points of resuscitation: correction of inadequate organ perfusion and tissue oxygenation. What are the clinical manifestations of inadequate perfusion and impaired oxygenation?

Traditional End Points of Resuscitation: Global Oxygenation Variables

Traditional clinical signs of inadequate perfusion and impaired oxygenation include hypotension, tachycardia, decreased mentation, and urine output. However, these signs can be misleading in trauma patients. They are sensitive but nonspecific indicators of physiologic abnormalities. "Normal" blood pressure is individualized. A blood pressure of 80/40 mm Hg may be normal for one patient, yet extremely hypotensive for another. Tachycardia can occur in response to shock, but may also be present in patients with anxiety, pain, fever, or substance abuse/withdrawal. Mentation is difficult to assess in trauma patients due to head injury and the presence of alcohol or other drugs. Clinicians often use urine output as a marker of adequate fluid resuscitation. However, adequate urine output in the face of hypoperfusion can occur during the initial neuroendocrine response to trauma as hyperglycemia results in osmotic diuresis. Similarly, massive amounts of diuresis may occur in head injured patients with diabetes insipidus.

A shock state may persist despite normalization of blood pressure, heart rate, and urine output. Scalea and colleagues reported that in 30 trauma patients, 24 (80%) had normal blood pressure, heart rate, and urine output despite the presence of elevated lactated levels and

decreased mixed venous oxygen saturation.[3] Abou-Khalil and colleagues evaluated 39 penetrating trauma patients who were younger than 40 years old.[4] They reported that despite normal heart rate, blood pressure, and urine output, only 15% had achieved an optimal state one-hour postoperatively. They concluded that traditional end points of resuscitation underestimate the degree of shock, particularly in young trauma patients who have compliant capacitance vessels and arterioles that maximally vasoconstrict. These studies demonstrate that trauma patients can remain in a state of inadequate tissue perfusion and oxygenation if resuscitation measures cease after traditional end points (blood pressure, heart rate, and urine output) have been normalized.

Lactate Levels

Inadequate tissue perfusion results in anaerobic metabolism, the byproduct of which is lactate. Therefore, monitoring serum lactate levels has been proposed as a clinical marker of inadequate perfusion. Abramson and colleagues prospectively studied lactate clearance and survival following injury in 76 critically ill trauma patients.[5] They reported 100% survival in 27 patients whose lactate level normalized (< 2 mMol/L) in 24 hours. If lactate levels cleared to normal between 24 and 48 hours, the survival rate was 75%. They concluded that time needed to normalize serum lactate levels may be an important prognostic factor for survival.

Abou-Khalil and colleagues prospectively studied 39 patients who had required operative intervention for penetrating trauma.[4] They found that at one hour and 24 hours post-operatively, survivors had significantly lower serum lactate concentrations than nonsurvivors. Manikis and colleagues investigated the correlation between blood lactate, morality, and organ failure in 129 critically ill trauma patients (100 survivors, 29 nonsurvivors).[6] Nonsurvivors and patients who developed organ failure had higher initial lactate levels and higher overall lactate levels. The duration of hyperlactatemia averaged 2.2 days in patients with organ failure and one day in patients who did not develop organ failure.

These studies suggest the magnitude and duration of lactic acidosis may be predictors of mortality and morbidity following trauma. However, there are multiple factors that can contribute to elevated lactate levels. Serum lactate levels are an aggregate of lactate production and lactate metabolism. As underperfused tissue beds are reperfused, accumulated lactate may be washed out into the circulation, thus spuriously increasing serum lactate levels.[7] Cancer can cause elevated lactate levels because tumors have a high rate of anaerobic glycolysis. The larger the tumor burden, the greater that lactate production. Patients with Type II diabetes mellitus have a defect in pyruvate oxidation that can lead to mild hyperlactatemia. Acute ETOH intoxication can contribute to elevated lactate levels because oxidation of ethanol in liver produces acetaldehyde and acetate which fosters the conversion of pyruvate to lactate.

In summary, lactate is a byproduct of anaerobic metabolism that may reflect inadequate oxygen delivery at the cellular level. Blood lactate levels may be used to assess adequacy of perfusion and prognosis in the critically ill trauma patient. If lactate is progressively clearing, shock may be in the process of reversing. If lactate fails to clear, then it is reasonable to look for a missed cause of shock.[5] To address the problem of interpretation of a single lactate level, using serial measurements as an indicator of improving or worsening organ perfusion and oxygen delivery has been advocated.[1]

Base Deficit

Base deficit is defined as the amount of base (mMol) required to titrate 1 liter of whole arterial blood to a pH of 7.40 with the sample fully saturated with oxygen at 37°C and PCO_2 of 40 mm Hg. It is calculated from an arterial blood gas and, thus, is widely available and readily obtained. Normal base deficit is +3 mMol to -3 mMol. It is used as an approximation of global tissue acidosis.

Rutherford and colleagues conducted a retrospective chart review of 3791 patients to determine the association of base deficit with mortality.[8] Data suggested that a base deficit of -15 mMol/L within 24 hours post-injury in a patient younger than 55 years of age (no head injury) was a significant marker of mortality. A base deficit of -8 mMol/L within 24 hours post-injury in a patient older than 55 years old (no head injury), or a young patient with a head injury, was a significant marker of mortality. They concluded that base deficit is an expedient and sensitive measure of both the degree and duration of inadequate perfusion.

The advantage of base deficit is that it is readily obtained by arterial blood gas analysis and is more rapidly estimated in the laboratory than serum lactate levels.[7] However, limitations of base deficit do exist and should be considered in their interpretation. Administration of sodium bicarbonate may alter the base deficit irrespective of the tissue oxygen debt. A normal base deficit can exist with hyperlactatemia when the lactate load has not overwhelmed the body's buffer system or when a preinjury base excess exists, such as in patients with emphysema who are chronic CO_2 retainers.[1]

Although a prospective study showing an improvement in base deficit during volume resuscitation

improves survival has yet to be performed, many trauma centers support the use of a normal base deficit—an appropriate end point of trauma resuscitation.[8]

Regional Markers: Gastric Tonometry

Global markers of tissue perfusion, such as lactate and base deficit, reflect the sum perfusion of all tissue beds in the body. However, blood flow is not uniformly distributed to all tissue beds and regions during shock when blood flow to the gut is redistributed to the systemic circulation to increase perfusion to vital organs. Therefore, monitoring gut mucosa may provide information about systemic oxygenation.

Gut perfusion can be estimated by gastrointestinal tonometry. The gastric tonometer is a conventional nasogastric tube that has a silicone balloon at its tip that is filled with normal saline. The tonometer is inserted into the stomach like a standard nasogastric tube. The balloon lies in close proximity to the gastric mucosa. The balloon which is permeable to CO_2, allows CO_2 to diffuse freely from the gastric mucosa into the saline filled balloon. After an equilibration period, the CO_2 of the saline balloon should equal that of the gastric mucosa. A sample of saline is withdrawn from the balloon, followed immediately by an arterial blood sample. The two samples are analyzed by a blood gas analyzer. The pCO_2 of the saline sample and the HCO_3 form the arterial blood gas sample and are used in the Henderson-Hasselbalch equation to determine intramucosal pHi.

There are several studies using gastric pHi in the evaluation and management of the resuscitation of trauma patients. Roumen and colleagues prospectively evaluated 15 multiple trauma patients.[10] Eight of the 15 patients had a low pHi once or more within the first 48 hours of admission. Two of these patients subsequently died and three developed organ failure. Patients whose pHi remained normal were discharged without complications. Chang and colleagues prospectively studied 20 multiple trauma patients and compared global oxygen transport parameters, lactate, base deficit, and pHi over the first 24 hours of admission.[11] Patients with low pHi on admission who did not normalize within 24 hours had a higher mortality (50% vs 0%, $P = 0.03$) and a higher incidence of organ dysfunction (2.6 organs/patient vs 0.62 organs/patient, $P = 0.02$) than those patients whose pHi corrected to normal within 24 hours. Chang and Meredith prospectively studied 20 critically ill trauma patients and compared global oxygen transport parameters, lactate, base deficit, and pHi.[12] They found that patients with a persistently low pHi had a higher mortality and higher incidence of organ dysfunction than patients whose pHi normalized within 24 hours post-admission.

The limitations of gastric tonometry have been extensively reviewed by Russell.[13] Calculation of pHi is based on the assumption that HCO_3 of the gastric mucosal tissue is in equilibrium with the systemic arterial HCO_3. This assumption may not always be correct. When gastric mucosal blood flow decreases in shock, local gastric tissue HCO_3 may be significantly lower than the systemic arterial HCO_3. Therefore, use of systemic HCO_3 to calculate pHi may overestimate gastric pHi. Calculation of pHi is also based on the assumption that systemic arterial pCO_2 is normal and, thus, does not need to be considered to interpret abnormal gastric pCO_2i. While this may be true in healthy volunteers, critically ill patients frequently have abnormal systemic arterial PCO_2 and acute changes in systemic PCO_2 can change gastric PCO_2 directly.

Although gastric tonometry may not be ready for routine clinical practice,[13] as its technology becomes more accurate, timely, and user friendly, pHi may become an established end point of resuscitation in trauma.[7]

Conclusions: Guidelines for Resuscitation

The optimal resuscitation end point in trauma remains elusive and is a major focus of research in trauma care.[7] There is not a definitive answer as to what constitutes adequate resuscitation. Several clinical parameters appear to be useful in determining end points of resuscitation. Elevated serum lactate concentrations, elevated base deficit, and low gastric pHi appear to be clinical manifestations of inadequate tissue perfusion and impaired oxygenation. Resuscitation end points used in combination appear to be superior to those used alone.[7,9] Current data support the use of base deficit, lactate, and gastric pHi as appropriate end points for the resuscitation of trauma patients and the goal should be to correct at least one, if not all three parameters (lactate, base deficit, pHi), to normal within 24 hours after injury.[9] ❖

References

1. Cornwell EE, et al. *Surg Clin North Am* 1996;76: 959-969.
2. American College of Surgeons. *Advanced Trauma Life Support*. 6th ed. Chicago, Ill: American College of Surgeons; 1997.
3. Scalea T, et al. *Crit Care Med* 1994;22:1610-1615.
4. Abou-Khalil B, et al. *Crit Care Med* 1994;22:633-639.
5. Abramson D, et al. *J Trauma* 1993;35:584-589.
6. Manikis P, et al. *Am J Emerg Med* 1995;13:619-622.
7. Mikhail J. *AACN Clinical Issues* 1999;10(1):10-21.
8. Rutherford EJ, et al. *J Trauma* 1992;33:417-423.
9. Porter JM, Ivatury RR. *J Trauma* 1998;44: 908-914.

10. Roumen RMH, et al. *J Trauma* 1994;36:313-316.
11. Chang MC, et al. *J Trauma* 1994;37:488-492.
12. Chang MC, Meredeth W. *J Trauma* 1997;42: 577-582.
13. Russell JA. *Intensive Care Med* 1997;23:3-6.

CME Questions

64. The approach that was most time efficient when inserting nasogastric tubes into conscious patients during trauma care was:
a. technical.
b. affective.
c. mixed.
d. blended.
e. no technique was more efficient than any other.

65. Which of the following statements about insertion of nasogastric tubes during trauma care is true?
a. It is most efficient simply to do the procedure and get it over with; explaining the procedure or comforting the patient just wastes time.
b. Comforting the patient prior to attempting NG tube placement reduces the number of attempts required to place the tube.
c. Comforting the patient prior to attempting NG tube insertion reduces retching and vomiting during the procedure.
d. Including comforting measures as well as attention to the technical aspects of the procedure increases efficiency.
e. Whether comforting measures are included has no effect on the duration of the procedure.

66. Which of the following is the most likely mechanism by which nitroglycerin reduces gastric ulcers and bleeding?
a. It reduces portal venous pressure and gastric varaceal bleeding.
b. Increases platelet cyclic GMP levels.
c. It is metabolized to nitric oxide, which improves gastric blood flow and inhibits leukocyte-endothelial adherence.
d. It increases the half-life of H2 antagonists.
e. None of the above

67. Which of the following statements is true?
a. Administration of inhaled nitric oxide prevents ulcer formation in critically ill patients.
b. Nitroglycerin therapy is associated with a reduced risk of gastrointestinal bleeding in hospitalized patients.
c. Patients receiving both nitroglycerin and omeprazole have an increased incidence of upper gastrointestinal bleeding.
d. Omeprazole releases nitric oxide into the gastric lumen.
e. H2 blockers such as ranitidine and cimetidine release nitric oxide into the gastric lumen.

68. Mortality among patients with acute necrotizing pancreatitis with and without infection, respectively, was:
a. 12% and 7%.
b. 24% and 3.5%.
c. 24% and 14%.
d. 36% and 3.5%.
e. 36% and 14%.

69. Which of the following statements is true about acute pancreatitis?
a. It is most often a mild-to-moderate and self-limited disease that requires supportive therapy and subsequent treatment of the underlying cause.
b. When infection occurs in necrotic pancreatic tissue the associated mortality increases by more than 5-fold.
c. The combination of clinical and radiological (computed tomographic) criteria identifies the majority of patients with severe acute pancreatitis.
d. All of the above
e. None of the above

70. The use of a respiratory therapy consult service had which of the following effects on the knowledge of internal medicine house officers about respiratory care ordering?
a. 30% decrease
b. 15% decrease
c. No detectable change
d. 15% increase
e. 30% increase

71. Which of the following are limitations of the study showing no impact of a protocol-driven respiratory therapy consult service on house officers' knowledge of respiratory care ordering?
a. Only two institutions were involved.
b. Responses were elicited from only a minority (33%) of house officers.
c. There is no way to determine impact at the bedside.
d. All of the above
e. None of the above

72. Research demonstrates that blood pressure, heart rate, and urine output:
a. are good predictors of mortality after trauma.
b. should normalize within 24 hours after traumatic injury.
c. are reliable parameters for shock resuscitation.
d. may be normal during shock states.
e. None of the above

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: Fewer Nosocomial Pneumonias with Noninvasive Ventilation

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California End-of-Life Changes Won't End the Debate

Is AB 891 a Step in the Right Direction or a 'Lawyer's Dream?'

By Julie Crawshaw

California often serves as a harbinger of future changes in the rest of the country. when the California Legislature recently enacted Assembly Bill 891, it ostensibly changed the face of health care end-of-life decisions made by a patient or surrogate decision-maker. Yet opinion in the critical care community is divided on just how much change the new law will actually affect.

"Bottom line? It makes some things simpler but I don't think it's going to make a lot of difference in practice," says David Hess, MD, FACCM. "My perception of the new law is that it cleared up some inconsistencies in the old law, but I don't see it as plowing great new ground."

Hess, who practices at three intensive care units in Bakersfield, Calif, says that the living wills AB 891 replaces covered situations that never applied to critical care anyway. "They set out very specific conditions under which the patient did not want to be treated, such as for a condition with a survival expectancy of fewer than six months," Hess says. "The problems faced in critical care are far too fluid for that, often changing on an hourly basis."

Hess points out that a patient with a terminal disease and fewer than six months to live isn't—appropriately, at least—going to die in an ICU. "They deserve dignity and comfort care, not ventilators and compressors," he says.

The other document previously available to patients in California was the durable power of attorney for health care, which designated a surrogate decision-maker to act for the incapacitated patient. "Within that, there could be some components that would provide guidance about what the patient would want the spokesperson to do given a certain set of circumstances," Hess says. "It worked reasonably well because at least the physician had someone to discuss alternatives with."

However, if the surrogate and patient had not discussed the patient's wishes in great detail, the surrogate was left without guidance. "Informed consent, durable powers, and living wills are all pieces of paper," Hess says. "If they're filled out without appropriate conversation and communication, they're useless."

Both Former Methods Now Repealed

AB 891 repeals both the previous statutory scheme for a durable power of attorney for health care (DPAHC) and the Natural Death Act. The act removes the Natural Death Act requirements that a patient be diagnosed as terminal or permanently unconscious by two physicians in order for his or her Natural Death Act Declaration to be effective. However, the two-physician rule still applies if the patient executed a Natural Death Act Declaration executed prior to July 1, 2000.

State legislators considered AB 891's new definition of "health care decision" a significant statutory change because it explicitly includes all categories of surrogates who may decide to withhold or withdraw life-sustaining treatment, including conservators and court-appointed designees. However, Hess says that as a practical matter, physicians could never get court-appointed people to make any decisions anyway. "In the county I live in, it takes an act of God to get one appointed in the first place," he says.

One change Hess does find important is that under the new law, patients functioning at full competence may choose to appoint a surrogate for health care decisions they do not wish to make. Unless patients were incapacitated, physicians, for instance, might have to go to a very alert 90-year-old woman who wanted her daughter to make the decisions and insist that she do so herself.

"Now if she doesn't want to know all the horrible things that can happen we can talk to the daughter instead," he says. Hess also sees the ability the new law gives patients to appoint a conservator for a specific hospitalization as a major improvement.

Under AB 891, a surrogate decision-maker may:

- Select and discharge health care providers and in-stitutions;
- Approve or disapprove of diagnostic tests, surgical procedures, programs of medication;
- Direct to provide, withhold, or withdraw artificial nutrition and hydration and all other forms of health care, including cardiopulmonary resuscitation.

AB 891 also:

- Outlines the duties of health care providers regarding advance directives and surrogate decision-makers and establishes immunity for good faith actions taken in connection with various health care decisions;
- Expands the definition of health care decisions to explicitly include decisions to withhold or withdraw life-sustaining treatment;
- Permits an adult with capacity to make health care decisions by giving an "individual health care instruction" either orally or on a written basis, and to designate a surrogate decision-maker for a particular course of illness or treatment;
- Creates uniform standards of decision making for all types of surrogate decision-makers using the patient's previously expressed wishes (either oral or written), or, in the absence of previously expressed wishes, the patient's best interests.

Preamble Declares Patient Rights

In the preamble to AB 891, the California Legislature declares the right of all adults to control decisions relating to health care, including decisions to withdraw or withhold life-sustaining treatment. It declares explicitly that a court is "not the proper forum in which to make health care decisions . . ."

Under the new law, a patient is presumed to have capacity to make health care decisions, to give or revoke an advance health care directive, or to designate or disqualify a surrogate. AB 891 defines the term "capacity" as a patient's ability to understand the nature and consequences of proposed health care, including its significant benefits, risks, and alternatives, and to make and communicate a decision.

The patient's primary care physician decides whether a patient has capacity. Neither a psychiatric consultation nor court intervention is required. AB 891 requires the physician who determines capacity to document that determination in the patient's record.

As before, a health care provider may presume that a written advance health care directive or a similar instrument executed in another state or in this state is valid.

Is AB 891 a Lawyer's Dream?

K. Dean Gubler, DO, MPH, FCCM, FACCM, a board-certified intensivist who practices in California, doesn't think many people would argue with the intent of the new law in terms of giving patients the right to choose the degree and extent of their therapy. But he says that AB 891 makes a complicated issue even more so. "I don't think it simplifies anything," Gubler says. "In fact, I think it puts the practitioner at greater risk for litigation."

Gubler says that expecting a patient surrogate to make what may well be life and death choices essentially puts the decision-maker in the position of practicing medicine without benefits of training and licensure. Also, the new law allows a health care provider to decline to implement a health care decision if the refusal is based on conscience or institutional policy and the provider transfers the patient. Gubler points out that this assumes that such a patient can be transferred. It does not clearly address the situation in which the patient cannot be moved. Gubler says that a physician who decides not to honor the wishes of the surrogate and attempts to disqualify him or herself from caring for the patient can be accused of abandonment.

"Unless transfer is of clear benefit to the patient, you can't transfer them," he says. "Even if you can find another physician for the patient, you can still find yourself in trouble under COBRA law, which has mandatory federal penalties attached to it."

Gubler says that unless there is complete agreement between all parties, which is rarely the case with the critically ill, the physician can't make a right decision. "What does that accomplish?" he asks. "People can wind up being kept alive against their own wishes. Patients who need aggressive therapy may not get it because one of the parties involved doesn't understand it."

Both factors dictate a longer hospital stay and greater cost. "This is a mine field to have to walk through," Gubler says. "It's very problematic."

Attorneys have advised that a decision to refuse care when a patient or surrogate demands it should be made

only if the provider has strong, clear policies in place and substantial support for the proposition that the treatment demanded by the patient or surrogate is contrary to accepted health care standards. In that event, the health care provider must inform the patient and surrogate decision-maker of this refusal to provide care and must continue care until a transfer is accomplished.

Providers can also find themselves facing legal actions from aggrieved patients or their relatives, who now have incentive to sue based on the potential to recover damages and attorneys' fees for violations of AB 891. The law imposes a new statutory penalty of $2500 or actual damages (whichever is greater) plus attorneys fees for intentional violation of AB 891. The attorneys' fees provisions signal an intent of the Legislature to enforce AB 891.

How to Create Advance Directives

The new law creates a new type of advance health care directive defined as "a patient's written or oral direction concerning a health care decision for the patient." A patient may give an instruction and designate a surrogate verbally, by informing his or her supervising health care provider, who then must enter it in the medical record. Such an oral designation is effective only during the course of the treatment or illness, or during the stay in a health care institution when the designation is made.

A valid individual health care instruction requires only a signature, date, and either notarization or the signatures of two witnesses. If the person who executes the directive resides in a skilled nursing facility at the time of executing the advance directive, an ombudsman must witness the document, even if it is notarized.

AB 891 imposes several important duties on health care providers with regard to health care decision making. Health care providers must:

- Communicate with patients about advance directives, including any revocation or modification of an advance directive;
- Enter advance directives, orally expressed wishes, and any revocation or modification into the medical record if they are available;
- Comply with advance directives and health care decisions made by a patient's surrogate decision-maker or else transfer the patient's care to another provider.

AB 891 also states that health care providers are not required to provide medically inappropriate care that is inconsistent with "generally accepted health care standards." This provision engrafts medical malpractice standards on health care decision making. In the absence of patient or surrogate consent, providers should cautiously approach the issue of refusing to provide care they consider to be medically inappropriate.

The law says that providers and institutions acting in good faith and in accordance with generally accepted health standards are immune from civil or criminal liability or discipline for unprofessional conduct if they:

- Comply with a health care decision of a person that the health care provider or health care institution believes in good faith has authority to make that decision, including a decision to withhold or withdraw care;
- Decline to comply with the health care decision of a decision-maker based on a belief that the person lacks authority; and
- Comply with an advance health care directive on the assumption that the health care directive was valid when made and has not been revoked or terminated.

Law Provides Some Immunity from Criminal Prosecution

The new law also contains provisions granting immunity from criminal prosecution, civil liability, discipline for unprofessional conduct, administrative sanction or any other sanction based on a health care provider's reliance on a request to forego resuscitative measures. That holds true:

- If the health care provider believes in good faith that the action or decision is consistent with a valid written document;
- And the health care provider has no knowledge that the action or decision would be inconsistent with the health care decision that the individual signing the request would have made on his or her own behalf.

A "Request to Forego Resuscitative Measures" may be in the form of a written document or prehospital "Do Not Resuscitate" form and may be evidenced by a so-called "DNR" Medallion. AB 891 makes the "Request to Forego Resuscitative Measures" effective in health care institutions, as well as outside of facilities.

AB 891 leaves several major issues unaddressed. For example, the health care community has long sought clarification of the legal order of surrogates: Who is the "closest available" relative or significant person to act as a substitute decision-maker when a patient is incapacitated but has no agent or conservator? Unfortunately, the new law does not answer this question. Health care providers must continue to follow their existing policies for selecting a surrogate. The law also fails to resolve an even more critical problem, namely how health care decisions may be made when there are no individuals "close" or "available" (or appropriate) to act as a surrogate.

On a practical, day-to-day basis, physicians will still simply have do the best they can in any given situation and hope it works out for the best. "There are lots of good stuff written in law that attempt to make us do the

right thing," Hess says. The bottom line is that these decisions can't be legislated. You do what you perceive to be the right thing, hopefully not in direct violation of those rules." ❖

Terminally Ill Cancer Patients Favor Right to Die

By Julie Crawshaw

Terminally ill cancer patients by and large support legalizing euthanasia and assisted suicide for instances when symptoms become too painful to bear.

The results of a survey appeared in the Sept. 11, 2000, issue of the *Archives of Internal Medicine*. Those who oppose legalizing such practices do so on religious or moral grounds, researchers reveal. The findings, they say, suggest that a consensus between those who oppose and those who support these practices is unlikely.

"It is apparent from these reasons that people with different opinions about legalization are not simply arguing for different sides of the same issue; rather, their positions are grounded in different issues altogether," concludes Keith G. Wilson, MD, with The Rehabilitation Centre in Ottawa, Canada.

Investigators found that of the 70 terminally ill patients interviewed, 73% believed that euthanasia and assisted suicide are acceptable practices, and 21% thought neither practice was acceptable and should not be legalized. Overall, if the practices were legal, 58% said they might decide to hasten their death if pain and physical symptoms were to become intolerable.

Researchers point out, however, that pain is not the only reason terminally ill patients wish to die. "Psychological and existential dimensions of suffering—which are perhaps no less central in determining quality of life—also emerge as important reasons behind patient requests for physician-hastened death," they conclude. ❖

Repository Launched for End-of-Life Information

By Julie Crawshaw

A leading national emergency medical information service announced the addition of a national repository for end-of-life medical information.

MedicAlert Foundation, the Turlock, Calif-based information service, launched the service in late August 2000. Medical preference documents for an individual's end-of-life care directives can be stored, including life support directives, resuscitation, organ donation, living wills, and power of attorney.

"This service responds to the need for fast and confidential access by medical personnel," notes Tanya J. Glazebrook, President and CEO of MedicAlert Foundation. "It's a natural extension of our services because we already store and transmit emergency medical information for millions of members around the world and are universally recognized within the health care community."

The repository offers a 24-hour call center operated 365 days a year in addition to:

- referral service for advance directives forms and assistance;
- verification of completed forms for all required signatures and contact information;
- physician and health care agent notification at enrollment and during medical events;
- family notification service;
- safe storage and transmission of advance directives regardless of health care setting.

Interested individuals can contact the MedicAlert Foundation. For more information, call toll-free at (888) 904-7630. World Wide Web: www.medicalert.org. ❖

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