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Should Family Members be Present During Invasive Procedures and CPR?

ABSTRACT & COMMENTARY

Meyers and colleagues surveyed family members and health care providers to determine outcomes of implementing an emergency department (ED) policy that permitted family presence during invasive procedures (IP) and CPR. The family member was required to: 1) be older than 18 years of age; 2) share an established relationship with the patient; and 3) not demonstrate behaviors suggesting extreme emotional instability, intoxication, an altered mental state, or combativeness. Outcomes were measured using two surveys (family, health care provider) completed less than 72 hours after the event, and an interview with the family member completed two months after the event.

The study took place at a large university-affiliated level 1 trauma center in Dallas, Texas. Of 54 family members approached, seven (13%) refused to participate, eight (15%) did not complete the two-month interview, and 39 (72%) completed the survey and interview. These 39 family members were 40 ± 13 years of age, predominately female (72%), and most often a son/daughter (31%), spouse (28%), or parent (23%) of the patient. They observed 24 IP and 19 CPR. The health care providers participating in the study included nurses (n = 60), residents (n = 22), and attending physicians (n = 14). The IP most frequently performed were endotracheal intubation, central line placement, lumbar punctures, chest tube insertion, and orthopedic reduction. Overall patient mortality was 56%.

Most family members (97.5%) indicated they had a right to be present and would do it again. Benefits cited by family members during interviews included relief from wondering about what was happening, verbal and visual knowledge about the patient's condition and care, ability to provide comfort and care, and the opportunity for closure. Problems included concerns about patient comfort, patient survival, staff competence, and costs of care.

Health care providers differed in their opinions. Nurses were more likely to support family presence during IP ($P < 0.001$) and CPR ($P < 0.001$) than residents. Attending physicians were also

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more likely to support family presence during IP (P = 0.03) and CPR (P < 0.001) than residents. Benefits of family presence as perceived by health care providers included greater understanding on the part of the family about efforts made for the patient, more time for education, and more professional behavior by care providers. A minority of health care providers (15%) felt that efforts were more aggressive during CPR than they might have been if a family member was not present. (Meyers TA, et al. *Am J Nurs* 2000;100:32-42.)

COMMENT BY LESLIE A. HOFFMAN, PhD, RN

Tradition supports excluding family members during CPR and IP because of concerns that the event might be too traumatic, clinician activities might be negatively affected, or risk of liability might increase. However, several recent studies have reported findings that suggest that family presence can be a beneficial experience. Using Emergency Nurses Association guidelines, Meyers et al developed a policy that included guidelines for such visits, including patient/family assessment, preparation of families for the visit, and support during and after the visit, and prospectively tested outcomes of its use. Results demonstrated that family presence was a beneficial experience despite more than half (56%) of the cases resulting in death of the patient.

Study data did not suggest differences in perception based on age, gender, education, or relationship to the patient. There were no instances in which a family member became disruptive and, based on the two-month interviews, no evidence of traumatic memories. These positive findings may have been, in part, due to the fact that observation in the ED was frequently (47% CPR, 21% IP) part of a continuum, as the family member present in the ED was also present in the prehospital setting.

Health care providers differed in their evaluations of the benefits and problems associated with family presence. More nurses (87%) than attending physicians (77%) or residents (33%) supported family presence during IP. Also, more nurses (96%) than attending physicians (79%) or residents (19%) supported family presence during CPR. These findings suggest that individuals with more experience in the ED setting or a longer relationship with the patient were the most supportive.

This study was conducted in one setting, only enrolled participants who met entry criteria and agreed to participate, and did not include attending physicians who were unwilling to enroll their patients. Thus, study findings should be replicated in other settings. Perhaps the most positive outcome of the study was the response of the institution. Following completion of the study, a written procedure for family presence was implemented in the ED and, in November 1999, adopted for hospital-wide use. ❖

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Complications of Prone Ventilation in ARDS

ABSTRACT & COMMENTARY

Synopsis: *Of nine patients with severe ARDS and refractory hypoxemia following multisystem trauma who were managed in the prone position, four experienced serious complications related to the positioning. Although this experience may represent a "worst case" scenario, it illustrates the potential hazards of this adjunctive approach to ventilatory support in ARDS.*

Source: Offner PJ, et al. *J Trauma* 2000;48:224-228.

Offner and colleagues at denver health medical Center report their experience with nine patients managed in the prone position during mechani-

cal ventilation for acute respiratory distress syndrome (ARDS) following severe, multisystem trauma during a 12-month period. The patients were identified retrospectively from among a prospective cohort of patients with severe multisystem trauma admitted to the intensive care unit (ICU) of a level 1 trauma center. Standard assessment methods were used to evaluate severity of illness and to diagnose ARDS. The nine patients reported included two women; their mean age was 29 years, and all had ARDS following blunt thoracic trauma. Mean duration of mechanical ventilation prior to prone positioning was 11 ± 1.7 days. All nine of the patients had been placed in the prone position because of refractory hypoxemia that could not be managed satisfactorily with positive end-expiratory pressure (PEEP) adjusted according to a standardized approach, along with a lung-protective ventilatory strategy aimed at maintaining safe inspiratory plateau pressures. Patients were placed in the prone position by four to six caregivers, including surgeons, nurses, and respiratory therapists, with special care given to all tubes and lines.

Four patients experienced serious adverse effects related to prone positioning. Four of the nine patients had midline incisions from exploratory laparotomy, and wound dehiscence occurred in one patient. Severe facial and upper chest wall pressure necrosis developed in two patients. The fourth patient experienced a cardiac arrest upon first being moved into the prone position.

Oxygenation, as measured by the ratio of arterial PO_2 to inspired oxygen fraction (PaO_2/FIO_2) initially improved in six of the eight patients in whom it was assessed, from 75 ± 7 to 147 ± 27 mmHg (P = 0.04). Offner et al do not report the duration of prone positioning, nor the ultimate outcomes (i.e., ICU or hospital mortality) in their patients. They conclude that although prone positioning may improve arterial oxygenation in patients late in the course of severe ARDS following multisystem trauma, it has the potential for serious complications.

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

As demonstrated by numerous studies, prone positioning often improves arterial PO_2 in patients with ARDS. However, to date there have been no published clinical trials showing a positive effect on survival. Data collection in a large-scale randomized, controlled trial in more than 50 Italian ICUs has been completed, although the results have not yet been released. Thus, prone positioning is currently in the same category as several other measures used in treating patients with severe ARDS that may improve oxygenation in the short term but that have not been shown to affect the ultimate outcome. Included in this category are inhaled nitric oxide, high-frequency jet ventilation, pressure control inverse-ratio ventilation, and various approaches to determining optimum PEEP.

Only one multicenter randomized, controlled trial in patients with ARDS has shown different outcomes with different approaches to mechanical ventilation. The results of that NIH-sponsored study have recently been presented internationally and are to be published in the May 4th edition of the *New England Journal of Medicine*. The article has been released to the press prior to publication, and is available on the Internet at http://www.nejm.org. This study showed that a lung-protective ventilatory strategy using assist-control ventilation and small tidal volumes with limited static inspiratory pressures and permissive hypercapnia improved survival by 25% as compared to the same mode with larger tidal volumes and higher inflation pressures. A previous, smaller study, from a single institution, showed that a lung-protective ventilatory strategy using pressure control ventilation and based on pressure-volume curves obtained during therapeutic paralysis significantly reduced mortality in patients with ARDS (Amato MB, et al. *N Engl J Med* 1998;338:347-354).

A substantial amount of potentially important information was not included in the paper by Offner et al. Although we are told that two patients were excluded from prone positioning during the same period because of open abdominal wounds following damage-control laparotomy, the proportion of patients turned prone to the total number of patients with severe ARDS during the study period is not provided. It would also have been instructive to know how long the nine reported patients were kept prone, and how many of them survived.

Although it is not stated explicitly, the nine patients included in this series likely represent early experience with prone positioning at Offner et al's institution. As they point out, these patients were late in the course of severe ARDS, and likely were more predisposed to skin breakdown and wound dehiscence because of poor tissue turgor and extensive third-space edema. These issues notwithstanding, this paper makes an important point. Despite deliberate, extensive efforts to prevent dislodgement of tubes and other adverse effects, prone positioning led to serious complications in several of the patients in which it was used. Particularly in the absence of evidence that this maneuver has a favorable effect on the ultimate outcome in patients with ARDS, clinicians should use caution and make sure that other aspects of manage-

ment that might also improve oxygenation are used optimally. ❖

Spiral Volumetric CT to Diagnose Pulmonary Embolism

ABSTRACT & COMMENTARY

Synopsis: *Of 11 published investigations of spiral volumetric computed tomography in the diagnosis of pulmonary embolism, none met all 11 standards applied by the authors for studies of diagnostic tests, and only five articles met five standards. Spiral CT can be helpful for "ruling in" pulmonary embolism, but not for excluding this diagnosis.*

Source: Mullins MD, et al. *Arch Intern Med* 2000; 160:293-298.

The use of spiral volumetric computed tomography (SVCT) to diagnose pulmonary embolism (PE) was first reported in 1992. Since that time, this technique has become more widely used to evaluate patients suspected of having PE. This study sought to determine whether current enthusiasm for SVCT in this context is justified by rigorously examining the available published studies of its use.

Mullins and associates at the University of Virginia performed a MEDLINE search for articles published up to mid-1998. They only included articles reporting comparisons of SVCT to the results of pulmonary arteriograms or another reference standard (such as a high-probability ventilation-perfusion scan in the presence of a high clinical suspicion for PE). To the published articles that met these criteria, Mullins et al applied 11 standards, adapted from accepted methods for scrutinizing studies of diagnostic tests (*see Table*).

Eleven studies were identified in the English literature prior to July 1998 that met the requirements of Mullins et al for inclusion. These studies came from six different countries, and reported on between 10 and 185 examinations. None of them met all 11 standards shown in the table. In fact, only five of them met five or more standards. Mullins et al conclude that there is not yet an established place for SVCT in the diagnostic evaluation of patients suspected of having acute PE. They point out that SVCT may be relatively sensitive and specific for diagnosing central pulmonary artery PEs, but that it is insensitive for diagnosing subsegmental clots.

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

Enthusiasm for and widespread clinical use of a new diagnostic technique typically precedes appropriate scientific studies of its validity and cost-effectiveness. This is particularly true for conditions that are potentially life threatening, and for which the existing diagnostic armamentarium is far from ideal. PE is one such condition. A killer of hundreds of thousands of people annually, PE is notoriously difficult to diagnose, particularly in the presence of underlying cardiopulmonary disease. Ventilation-perfusion scanning is highly accurate in otherwise healthy patients when the history is typical and there are neither coexisting medical problems nor technical difficulties. When these conditions are not met, however, as tends to be the case in the ICU, the ventilation-perfusion scan all too often yields unhelpful "indeterminant" results. The currently popular ultrasound studies of the lower extremities are highly operator dependent and cannot say whether a clot is present in the lungs. The gold standard for diagnosing PE, pulmonary angiography, is invasive and not always easy to obtain.

Table

Standards by Which Published Studies of SVCT Were Examined

1. Clear description of SVCT technique
2. Clear criteria for positive or negative result
3. Assessment of interpretation reliability by comparing independent (blinded) readings
4. Assessment of reliability of SVCT by having some patients undergo repeated testing with comparisons of both tests
5. Sufficient description of patient selection process so that similar patients could be studied
6. Sufficient description of patients themselves for reader to make comparisons with his/her own patients
7. Sufficient description of eligible patients who were not enrolled in study
8. Sufficient description of extent of disease so that results could be stratified by location or severity of PE
9. Sufficient detail on non-PE diagnoses so that inference of discriminative ability of SVCT for patients without PE possible
10. Referral of patients for SVCT and reference standard regardless of results of either
11. Results of SVCT and reference standard interpreted independently

It is no wonder that SVCT has been so enthusiastically embraced by clinicians and radiologists alike. It is easy and quick to perform, and more and more reliance is being placed on its findings. In many institutions SVCT has rapidly become the initial diagnostic study of

first choice for patients suspected of having PE. But is this trend justified?

This systematic review points out how incomplete the current database is with respect to using SVCT to diagnose PE. Especially, this test cannot be used to exclude this diagnosis with confidence. SVCT is highly specific for PE, and if it shows a big clot in a central pulmonary artery, the diagnosis is made. However, when a clot is not seen on SVCT, PE has definitely not been excluded. Thus, as Mullins et al point out, SVCT may have a role as a "rule-in" test for large central emboli, but additional research is required to establish its place in clinical practice. ❖

Ventilator Weaning by Protocol is Practical and Effective

ABSTRACT & COMMENTARY

Synopsis: *A weaning protocol administered by respiratory therapists and authorized by each patient's managing physician gained increasing acceptance in Ely and colleagues' institution over the 12 months included in this study. Ely et al also identified and dealt with a number of barriers to protocol implementation.*

Source: Ely EW, et al. *Am J Respir Crit Care Med* 1999;159:439-446.

This paper documents the process by which therapist-driven protocols (TDPs) for weaning patients from mechanical ventilation were successfully implemented in Ely and colleagues' institution, a large university teaching hospital. During a 12-month period, Ely et al reintroduced a previously validated TDP throughout the hospital. This protocol relied on daily patient screening by respiratory therapists and requests to the patients' managing physicians for permission to perform a spontaneous breathing trial.

The "readiness to wean" screen was considered to have been passed by the patient if all of the following criteria were met: the minute ventilation was less then 15 L/min, the inspired oxygen was less than 60%; positive end-expiratory pressure (PEEP) was less than 10 cm H_2O, the PaO_2/FIO_2 ratio was greater than 200 mmHg, the rapid shallow breathing index (spontaneous tidal volume divided by respiratory rate) was 105 breaths/min/L or less, the patient had an adequate cough with suctioning, and there was no requirement for continuous infusion of pressor agents. If the managing physician provided an order to proceed with a spontaneous breathing trial, the patient was allowed to breathe through the ventilator circuit with 5 cm H_2O or continuous positive airway pressure and flow triggering but without other support, or to be switched to a T-piece circuit. During the trial the patient was continuously monitored by the respiratory therapist and bedside nurse, who used pre-established criteria to return the patient to ventilatory support if spontaneous ventilation was not tolerated. Unassisted breathing for 30 to 120 minutes that was well tolerated by the patient was considered a positive trial.

During the 12-month study period, 1067 patients with respiratory failure required 9048 days of ventilatory support and were cared for by 117 respiratory therapists. With an intensive therapist education program about the use of the TDP, there was a progressive and significant increase in the rate of implementation of spontaneous breathing trials once daily screen criteria were met. As the year progressed, the number of participating physicians significantly increased. However, a number of problems were also identified. Spontaneous breathing trials were ordered more often on medical services than on surgical services (81 vs 63%; P = 0.004), and a questionnaire was used to determine physician barriers to protocol implementation.

Based on their experience with this study, Ely et al conclude that large-scale implementation of a TDP for ventilator weaning that does not require direct involvement of the managing physician during the weaning process is feasible in a large academic medical center. Further, they conclude that respiratory therapists can appropriately perform patient assessments and correctly interpret the data 95% of the time. Ely et al also emphasize the importance of recognizing barriers to successful implementation of a TDP for weaning. They point out the need for a staged implementation process, for intensive education of the respiratory therapists actually carrying out the protocol, and for periodic reinforcement of all participants in the process.

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

Ventilator weaning has come full circle in the last 25 years. Before the mid-1970s, patients were fully supported until clinical assessment predicted that ventilation could be adequately maintained spontaneously, and then a trial of spontaneous breathing was carried out to determine whether that prediction had been correct. With the introduction of intermittent mandatory ventilation and later of pressure support as weaning techniques, focus shifted to the empirical reduction of ventilatory support, with assessment as to whether the patient was tolerating it. Attention tended to focus on the weaning

technique rather than on the patient's condition, and the assumption was often made that progressively stressing the ventilatory muscles would eventually enable the patient to breathe unassisted. In the last year or two, we have begun to return to the notion of more fully supporting ventilation, and periodically checking to see whether the patient has recovered to the point where spontaneous ventilation can be resumed.

This paper shows that a TDP based on daily patient screening for readiness to wean can be put into widespread clinical practice in the setting of a large teaching hospital. It takes a while for physicians to become comfortable with the idea of "turning their patients over to a protocol" rather than individually ordering every change in ventilator settings during the weaning process. However, the gradual transition documented here by Ely et al has been played out at numerous hospitals throughout the United States—and in community hospitals as well as big university teaching hospitals.

This paper also draws attention to a number of the problems encountered in implementing weaning protocols, and should facilitate the process in other institutions. The actual weaning protocol used by Ely et al, provided in the article's appendix along with its accompanying documentation form, could probably be adopted unchanged in many institutions, avoiding the necessity of "reinventing the wheel." In other practice environments, however, clinician acceptance of TDPs may hinge on their incorporation of familiar local management routines. Whichever route is taken, it is likely that weaning by TDPs will be done in more institutions in the coming years. ❖

Special Feature

Pressure Control Ventilation: Practical Steps for Patient Management

By Edgar Delgado, BS, RRT and Leslie A. Hoffman, PhD, RN

In the early 1970s, siemens[1] introduced the use of a microcomputer to control respiratory valves. These servocontrolled valves provided the apparatus required for the development of the pressure-controlled, time-cycled mode of ventilation known as pressure control ventilation (PCV).[2] Subsequently, PCV has gained popularity as a method to manage patients who require mechanical ventilation as a consequence of conditions such as acute lung injury (ALI) and acute respiratory distress syndrome (ARDS). Although PCV has been used extensively, a standard approach to patient management when using this ventilator mode has not been established. This essay provides a brief overview of the characteristics of PCV, a suggested approach for initiating PCV, and recommendations for patient monitoring.

Overview of PCV

PCV allows the clinician to preset a maximum level of pressure delivered to the airway, as well as a predetermined inspiratory time for each controlled mechanical breath. In contrast, during conventional volume-controlled ventilation (VCV), the clinician controls the minimum volume of gas delivered into the patient's lung each minute by setting tidal volume (V_t) and frequency (f). The speed at which the gas is introduced into the airways, termed inspiratory flow rate, is also controlled by the clinician during VCV.[2,3]

The way in which gas is delivered to the lung is perhaps the most significant difference between VCV and PCV. A square-flow waveform is often used to deliver VCV. The flow rate and shape of this waveform are predetermined, regardless of patient effort. During PCV, the flow waveform and rate are not predetermined, thereby permitting variability of flow characteristics as a function of several factors. Flow of gas into the lung is determined by the set inspiratory pressure, the inspiratory-to-expiratory (I:E) ratio or length of inspiratory time, lung resistance and compliance, patient effort, and certain limitations within the flow control algorithm that are specific to the ventilator used.[3]

Also, the flow pattern is decelerating or "ramp-type" in nature. Inspiratory flow is initially high, reflecting the large gradient between alveolar and proximal airway pressure, and then decelerates as this pressure gradient falls. Some clinicians have theorized that the early and sustained increase in intra-alveolar pressure created by a decelerating flow pattern might facilitate gas exchange within the lung, but this potential has not been proven.[2,4] Additional advantages reported with PCV include an increase in arterial oxygen tension (PaO_2) while maintaining a lower peak airway pressure (P_{peak}), FIO_2, positive end-expiratory pressure (PEEP), and minute ventilation (V_E).[5-7]

Several scenarios may prevent the set target inspiratory pressure from being reached during PCV. In situations when a long inspiratory time is used, flow will reach zero prior to time cycling (termination of inspiratory phase) of the mandatory breath. Here, the set target pressure is usually reached. In other scenarios (e.g.,

use of a short inspiratory time), flow may not reach zero prior to time cycling. In this situation, set target inspiratory pressure may not be obtainable. Therefore, the clinician needs to determine if the set pressure is actually reached.

Depending on dynamic ventilatory parameters, V_t may also vary. Generally, as compliance decreases or resistance increases, V_t will be reduced. Conversely, if compliance increases or resistance decreases, V_t will increase. Additional considerations relate to the development of intrinsic positive end-inspiratory pressure (auto-PEEP). During PCV, the V_t delivered to the patient is determined by the difference between the set inspiratory pressure and total PEEP (ventilator PEEP + auto-PEEP). Accordingly, any change in auto-PEEP will alter total PEEP and consequently V_E unless set inspiratory pressure is increased. Similarly, any increase in ventilator (applied) PEEP will decrease the delivered V_t unless the set inspiratory pressure is increased.

Suggested Approach for Initiation of PCV

The following approach for implementation of PCV has been used at our institution (University of Pittsburgh Medical Center [UPMC]-Presbyterian) since 1992. Our approach is similar to that described by Howard.[7]

- Consider using PCV when Ppeak approximates 40 cm H_2O with PEEP ≥ 10 cm H_2O.
- Obtain a baseline arterial blood gas (ABG).
- Set the ventilator mode to assist control, and match the f, FiO_2, PEEP, and I:E ratio to the VCV settings.
- Set the initial inspiratory target pressure at 75% of the difference between P_{peak} and PEEP while on VCV.
- Increase set inspiratory pressure until the desired V_t is obtained. For example, if P_{peak} on VCV is 39 cm H_2O and PEEP is set on 12 cm H_2O, the difference is 27. Seventy-five percent of 27 is 20.25; therefore, the initial inspiratory pressure setting is 20 cm H_2O. Increase the pressure in increments of 5 cm H_2O until the desired V_t is obtained. There is no magic in this procedure. However, it establishes a conversion from VCV to PCV without exceeding the P_{peak} during VCV, and in many situations permits a lower P_{peak} than during VCV with comparable V_t.[3]
- Obtain an ABG within 30 minutes (or sooner) and make further adjustments as necessary.

Pressure Control with Inverse Ratios

In scenarios where recruitable lung units are present, sustained elevations in airway pressure tend to be more effective for the recruitment of alveoli than transient elevations.[4] Conceptually, pressure control-inverse ratio ventilation (PC-IRV) permits sustained pressure elevation and facilitates recruitment of collapsed alveolar units, subsequently decreasing dead space ventilation. With the decrease in dead space ventilation, it may be possible to reduce V_E (by decreasing V_t or f while maintaining the desired $PaCO_2$). Potentially, this adjustment may translate into a reduction in P_{peak}.

At UPMC-Presbyterian, we use the following approach to initiate PC-IRV:

- Provide sedation and/or paralysis as indicated.
- Obtain a baseline ABG.
- Keep f the same as PCV without an inverse ratio. Set the FIO_2 to 1.0 for several minutes. Set the I:E ratio to 1:1 prior to inverting the ratio.
- Set the I:E ratio at 2:1.
- Assess the effect of this change on mean airway pressure. If the change in mean airway pressure is not desirable, decrease ventilator PEEP to match the mean airway pressure prior to inverting the ratio.
- Obtain an ABG and make further adjustments as necessary.

Monitoring During PCV

Monitoring during PCV does not differ substantially from routine management of the mechanically ventilated patient in an ICU. However, several parameters require particular attention. As adjustments to the preset inspiratory pressure, I:E ratio, or inspiratory time, frequency, and/or PEEP are made, mean airway pressure and V_E may be affected. In addition, auto-PEEP may develop as a result of shorter expiratory times. Therefore, it is imperative to monitor these ventilatory parameters and make certain that the changes produced provide adequate oxygenation and ventilation with the lowest possible mean airway pressure.

In situations when PC-IRV is used, sedation and paralysis are strongly recommended. Patients typically do not tolerate PC-IRV without sedation and paralysis because it is not compatible with a normal breathing pattern. If patients are allowed to breathe above the set ventilatory rates, hemodynamic compromise and barotrauma are likely complications.

To reduce exposure of the lung to high airway pressure in patients with ALI or ARDS, mechanical ventilation should be conducted with sufficient PEEP to prevent end-expiratory collapse and tidal recruitment, and with a small tidal volume to avoid ventilator-induced lung injury. This goal may be facilitated by use of VCV or PCV. One advantage of PCV is the ability to easily designate a set inspiratory pressure that represents a limit alveolar pressure cannot exceed under conditions of passive ventilation. Consequently, PCV is commonly used in our

institution when managing the care of patients with ARDS. Use of PCV requires an understanding of the complex interrelationships that occur when using this ventilatory mode and careful patient monitoring to ensure that the desired goals are met. (*Edgar Delgado is Education, Research, and Quality Improvement Coordinator in the Respiratory Care Department at the University of Pittsburgh Medical Center.*) ❖

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CME Questions

1. **Presence of a family member during invasive procedures and CPR was viewed most favorably by:**
   a. attending physicians.
   b. residents
   c. nurses.
   d. triage staff.

2. **Family members viewed their presence favorably when:**
   a. invasive procedures and CPR were performed.
   b. invasive procedures, but not CPR, were performed.
   c. CPR, but not invasive procedures, was performed
   d. the patient survived CPR.

3. **In the diagnostic evaluation of patients suspected of having pulmonary embolism, spiral volumetric computed tomography:**
   a. is the gold standard.
   b. can rule in large central emboli.
   c. has replaced the ventilation-perfusion scan.
   d. is useful in excluding small peripheral emboli.
   e. All of the above

4. **The gold standard for diagnosing pulmonary emboli is:**
   a. ventilation-perfusion scanning.
   b. lower extremity Doppler studies.
   c. pulmonary angiography.
   d. spiral volumetric computed tomography.
   e. 55° oblique hilar tomography.

5. **A spontaneous breathing trial would be recommended in a patient with all but which one of the following findings?**
   a. A PaO_2/FIO_2 ratio of 250 mmHg.
   b. An FIO_2 of 55%.
   c. A spontaneous tidal volume over respiratory rate of 80 breaths/min/L.
   d. A positive end-expiratory pressure of 12 cm H_2O.
   e. A minute ventilation of 12 L/min.

6. **In the study by Ely et al on implementing weaning protocols, which of the following was found?**
   a. Attending surgeons adopted the protocol more readily than internists.
   b. Use of the protocol declined as the year progressed.
   c. Respiratory therapists could perform the assessment and correctly interpret the data 95% of the time.
   d. All of the above
   e. None of the above

7. **Prone positioning in patients with severe ARDS:**
   a. decreases the incidence of ventilator-associated pneumonia.
   b. improves ultimate survival by 25%.
   c. frequently improves arterial oxygenation.
   d. All of the above
   e. None of the above

8. **Which of the following has been shown in randomized controlled clinical trials to improve survival among patients with ARDS?**
   a. Prone positioning
   b. Inhaled nitric oxide
   c. Pressure-control inverse-ratio ventilation
   d. Lung-protective ventilation with low tidal volume, low plateau pressure, and permissive hypercapnia
   e. None of the above

9. **During PCV, set inspiratory pressure is likely to be reached if:**
   a. inspiratory time is long.
   b. inspiratory time is short.
   c. inspiratory time is allowed to vary on a breath-to-breath basis.
   d. patient breaths are interspersed with machine breaths.

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Communication, Best Practices are Key to Hospitalist Programs

Collaboration with primary care physicians critical

There's no magic involved in building a successful hospitalist program, just some key fundamentals, says Ronald A. Greeno, MD, a co-founder and vice president of network development for Cogent Medical Care, Laguna Hills, CA.

Those include voluntary participation, clearly delineated responsibilities, and complete, open communications between hospitalists and primary care physicians (PCPs), he says. Greeno is obviously an advocate of hospitalist systems and maintains that "a well-designed and administered hospitalist plan is simply a better model of care." He emphasizes that a well-structured program is never mandatory, but allows the PCPs the option of turning their patients over to the hospitalist program. And when PCPs decide to turn their in-hospital work over to one of Cogent's hospitalist programs, everything that's going to happen regarding patient care has already been clearly spelled out and agreed to by all parties. This includes not only in-hospital patient management but all the process issues that surround a patient's hospitalization as well.

Greeno adds that in a good hospitalist program, the PCP has clear expectations of the hospitalist team for both the patient's clinical management and the process issues that surround hospitalization. "The only way to do this is for the participating physicians to agree on what the expectations will be, educate everyone as to what the expectations are, then put a system in place that allows tracking to see if they were met. "That's what we've done to standardize care across a network of hospitalist physicians," Greeno says. "What is a true hospitalist practice? There is no uniform set of standards," says Greeno. "Right now, any generalist or medical subspecializing physician can say 'I'm a hospitalist and if you want me to take care of your patients in the hospital, I'll do that.'"

He adds that some programs merely change the staffing model by sending the patient to a small group of doctors in the hospital. "At Cogent," Greeno says, "we decided it isn't sufficient just to change who takes care of patients in the hospital. We improved the model to create a higher level of patient care and put the systems in place that ensure it."

Data equals best practice standards

Cogent hospitalist programs use data management to elevate the standard of care for hospitalized patients by consistently applying evidence-based medicine, Greeno says. He notes that best practice standards are supported by medical literature and have been agreed to by a large number of physicians across a wide geography. Yet even though certain things have now been identified as best medical practices, many times those practices are not implemented.

For example, best practices now call for putting most patients with congestive heart failure on an ACE inhibitor. "The evidence is clear from the medical literature, and it has been there for years," Greeno says. "Yet if you look at any population of patients in the country, up to 70% of them are not on these medications."

Clearly, hospitalists can't do anything about patients who have heart failure who don't end up in the hospital. But all patients with heart failure who come into a Cogent-run program are evaluated for taking an ACE inhibitor prior to their release, he says.

"Our data collection system allows us to measure how well we are meeting best practice standards," Greeno says.

"We track results and feed that information back to the physicians so that they can see if they need to make improvements."

He notes that outcomes data are becoming more important as time goes on. "The government is going to expect it, our peers are going to expect it, and physician groups that are able to demonstrate their outcomes will be way ahead of groups that can't."

Communication should be constant

Constant communication between the hospitalist team and the PCP, both during the hospitalization and when the patient transfers back to the outpatient arena, is central to success, Greeno says.

Cogent-trained hospitalists initially obtain a newly admitted patient's medical history to complete their own database. Any key event that occurs for that patient during hospitalization is immediately relayed to the PCP.

"We have a list of mandatory status changes we require our hospitalist team to report to the primary care physician, ranging from change in code status to death," says Greeno. "We also document those changes in our data system so that we know when that communication happened."

These hospitalists fax a database-format discharge letter to the PCP that includes information on diagnosis, procedures, consultants, medications, suggested follow-up, and home health care. The PCP then has a hard copy in hand for the patient's next appointment. The same information is entered into the hospitalist team's database in case the patient is readmitted or admitted to another hospital in the same city.

Cogent also uses a Web-based database accessible to any hospitalist physician with security clearance.

"Many times patients are admitted to a second hospital, where they have no medical records," Greeno says. "What we are doing is tying the patient's medical information to the patient rather than an institution and making it readily available to the people who need to make rapid clinical decisions should the patient be admitted to a hospital again."

Patient discharge information is also available to the personnel at Cogent's call centers, who contact patients after they go home and review their discharge information with them to make sure their discharge plans are being implemented. Did they pick up their medications? Do they know how to take them? Do they have a way to get to their follow-up appointment? Did their oxygen and home health care provider arrive?

If a patient answers "no" to any of these, a nurse trained as clinical care coordinator by Cogent handles the problem. "Without this follow-up, you'd never know about these things until the patient was readmitted, Greeno says. "All of this is driven by a two-minute dictation the hospitalist makes at the time of discharge. The database entries, follow-up phone call, patient satisfaction survey all flow from a single process put in place by the hospitalist."

Data management saves time and money

Greeno, who is triple-boarded in internal medicine, pulmonary, and critical care, also co-directs the critical care unit at Good Samaritan Hospital in Los Angeles. He observes that many hospitals waste huge amounts of their time and money resources because personnel don't know the right way to do things and are not available when decisions need to be made. "For example," he says, "a patient is admitted to one hospital and gets an MRI. A week later, the same patient is admitted to a second hospital and gets a second MRI because nobody knew about the first one."

He points out that sometimes a patient can remain in a hospital for days with little being done because his or her PCP needs to see 30 patients per day in the office and isn't available to follow up on hospital tests. "When we started this organization," Greeno says, "we saw that the number of health care resources was about to be limited. Now, medical-care providers in this country are almost in a position where it's necessary to ration health care, yet 30-40% of the dollars spent on hospitalized patients is wasted because no one was focusing on the patient's in-hospital care."

Cogent was started by groups of physicians who wanted to be hospitalists but wanted access to infrastructure in order to deliver a better program. "We couldn't do it as individual groups, so we got together as a larger group to create that infrastructure," Greeno says. "Then other groups became interested in having us help them."

The company has built its standard operating model by installing information systems that gather performance data, evaluating those data, and putting systems into place that increase reliability of communications with PCPs.

The company's customers are organizations with a group of patients for whom they are at risk who contract with Cogent to build and manage a hospitalist system.

This is how Cogent puts a hospitalist program in place:

- Finds physicians within the community who want to be in the hospitalist business for a particular patient population. "We don't employ physicians or buy physician practices," Greeno says. "We use physicians who are already practicing in those hospitals."

- Contracts with those physicians who want to use Cogent's model to bring them the population of patients they desire. Those physicians are independent contractors with Cogent, taking care of those patients in that hospital.
- Hires and trains the nurses who coordinate clinical care.
- Puts in information systems and operations people. "We have people who stay in that market who make sure that the operation continues to run smoothly. You can't just set these things up and expect them to run smoothly," Greeno says.

Cogent's hospitalist program implementation takes about a 120 days before the first patients are seen. The model is designed to make doctors more efficient and to put processes and people in place to support them.

The company has put hospitalist programs in about 55 hospitals in nine states. Growth has been rapid. Cogent's first program began in October 1997.

"What you are saying by virtue of using a hospitalist model is that you can do a better job of taking care of patients," Greeno says. "Unless you are prepared to demonstrate that, you shouldn't be saying it." ❖

Source

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Hospital Battles Back Injuries with Zero Lift

New equipment allows for smoother transfers

Patient handling can have costly consequences. At the University of Kentucky Chandler Medical Center in Lexington, 21 back injuries in the intensive care unit led to $42,000 in medical expenses in one year alone.

When hospital safety officer Tomi Ross examined back injuries hospitalwide during 1998, she calculated medical costs of $119,000—and much more for replacement staff.

Now, the hospital has a new policy: zero lift. "In any patient move or transfer for which there is an established protocol, you must follow that. You must not lift," says Ross.

The medical center backed that policy up with an investment in state-of-the-art patient-handling equipment. For example, On3 by Ergodyne in St. Paul, MN, is a lateral transfer device that uses draw sheets, poles, and belts to move a patient from a bed to a stretcher. One worker guides the transfer and another stands by in case there is need for assistance.

Neither worker carries any weight, even if the patient weighs as much as 400 pounds. "It actually pulls the patient from one surface to the other, so there is no lifting by staff," says Ross.

"It's a smoother transfer from a bed to a stretcher with the On3 device," she says. "We think it will increase patient satisfaction, too."

New beds reduce need for transfers

The hospital also purchased sling lifts and stand-assist devices, which help patients move from a sitting to a standing position.

In fact, the back injury project began with the purchase of new beds throughout the medical center. These beds actually fold into a sitting position, allowing incapacitated patients to sit up with greater ease and somewhat ambulatory patients to exit the bed from a sitting position.

"If the reason for a bed-to-chair move is to reduce the risk of pneumonia and increase respiration, all they have to do is fold the bed and they're sitting up," she says.

Ross placed ergonomics equipment in the ICU and its ancillary areas. If the study project proves successful in reducing injuries, she plans to expand it hospitalwide.

Ross also designed her program to comply with the new ergonomics standard proposed by the U.S. Occupational Safety and Health Administration. That doesn't mean employees will never lift; there may still be some occasions in which there is no alternative to manually assisting a patient, says Ross. But the policy specifies that "if there is an accepted or established alternative, you have to use that," she says.

Program complies with OSHA regulations

Today's ergonomics fixes are more likely to be successful than earlier approaches, says Guy Fragala, PhD, PE, CSP, director, environmental health and safety at the University of Massachusetts Medical Center in Worcester.

"It's been difficult to find good ergonomic solutions for health care," says Fragala, who is consulting with the University of Kentucky Chandler Medical Center. "We haven't had a lot of options in the past. But now many options are becoming available."

Some devices require a substantial investment, such as the On3, which costs about $10,000. Ross estimates she would need 30 of them to cover the entire hospital. But other devices, such as friction-reducing devices to

assist in lateral transfers, are low-tech, inexpensive solutions.

Ease of use is important to ensure employee compliance. "This is not the first time we bought equipment," says Ross. "When we do inspections, we find the lifts in the back of the storage closet. We find a high incidence of back injury in those units."

Ross has told managers they are responsible for monitoring safety in their areas. Employees have also been trained in the zero-lift techniques and told of the policy that they must use these alternative methods of patient handling as long as they're available.

"If you make it a condition of employment to comply with safe work practices and you're unequivocal about it, that becomes the standard," she says. ❖

Can Your Facility Succeed with Its Hospitalist Program?

10 critical 'musts' your program needs

Maybe you think your hospital, physicians, and patients can benefit from a hospitalist program. Maybe you are right. But before you get started, you need to make sure that the following 10 factors apply. Without them, says Dorothy Merriwether, president of the Houston consulting firm D. Merriwether & Associates, you limit your chance at success:

- **Supportive hospital administration.** Merriwether says this means that the administration works collaboratively with medical staff to implement a program that meets community needs.
- **Capability of gathering and sharing data.** You have to have the technology, personnel, and willingness to gather data on length of stay, cost per admission, high-cost DRGs, and patient demographics. And, says Merriwether, you have to be willing to share it with the hospitalists so that they and you can assess their performance and look for areas that need further improvement.
- **Mechanisms and personnel to educate physicians and patient population.** You need to be able to help educate the physicians on what the system is and isn't, says Merriwether. For instance, it isn't a method of dealing with indigent patients. It is a tool for your case management repertoire.
- **Mutual trust across departments and specialties.** Everyone has to be able to buy into the program and put the common good above that of his or her own specialty and department, says Merriwether. Turf wars only exacerbate the kind of problems you are trying to cure.
- **Team spirit among physicians providing hospitalist services.** The inpatient management group has to be cohesive, Merriwether explains. Group members must share the same values and commitment to make it work. Productivity-based compensation helps this, preventing one member of the team from reaping the rewards of the system while not putting in as much work as the others.
- **Intact and active spiritual support program.** Recent studies have shown the link between spirituality and healing. This is something that Merriwether says the hospitalist groups she works with have noted anecdotally for a long time. Many of the patients are seriously ill and need spiritual counseling. Hospital chaplains can also help direct poorer patients to some of the social and community services they may need.
- **Active case management program.** This is pretty self-explanatory, says Merriwether. But the point is that hospitalists can't be the only piece of a case management system. They are merely a part of it.
- **Strong emergency room department with fee-for-service reimbursement.** When the ED is based on a fee-for-service system, its physicians are encouraged to turn over the rooms quickly. Merriwether says this helps to align incentives with the hospitalists, who are there to expedite patients through the system. "If ED doctors are on a flat fee, they aren't [motivated] to turn the rooms over faster."
- **Balanced payer source.** Your payer mix will determine if a hospitalist program is viable, says Merriwether. "If you have a lot of indigent care, this probably won't work. If you have a high percentage of managed care, the physician is paid on a capitated and performance bonus system and there is a per diem system at the hospital, you don't have aligned incentives. If you have a high Medicare and Medicaid patient population, this is not as profitable to the hospital. You really need to have a balanced payer source."
- **Recognition of hospital needs to compensate hospitalists to alleviate financial burden of indigent care.** A hospital must determine if it wants hospitalists or an indigent care program, Merriwether says. "You have to proportionally share the burden of indigent care throughout the physician community, or you have to provide compensation for the hospitalists doing this care." ❖