

Critical Care [ALERT]

Authoritative, evidence-based summaries for the critical care clinician

ABSTRACT & COMMENTARY

Therapeutic Hypothermia: How Cold Is Cold Enough?

By James E. McFeely, MD

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Dr. McFeely reports no financial relationships relevant to this field of study.

SYNOPSIS: This large clinical trial of targeted body temperature — 33°C vs 36°C — following cardiac arrest showed no differences in survival or neurological outcome in the two temperature groups.

SOURCE: Nielsen N, et al and the TTM Trial Investigators. Targeted temperature management at 33°C versus 36°C after cardiac arrest. *N Engl J Med* 2013;369:2197-2206.

Over the last 10 years, induced hypothermia after out-of-hospital cardiac arrest has become the standard of care. This new intervention is based on two studies that were published in 2002 with a total of 352 patients showing improvement in survival and neurologic outcomes in a select group of patients with successful out-of-hospital resuscitation.^{1,2} These patients were presumed to have arrests of cardiac origin with initially shockable rhythms. Since that time, use of therapeutic hypothermia has been extended to cardiac arrest with other rhythms and for in-hospital arrests. Questions remained,

however, regarding the optimal target temperature and whether the treatment effect was due to induced hypothermia or prevention of fever.

This very large trial of targeted temperature management (TTM) was recently published. A total of 950 unconscious adults were randomized to a TTM goal of either 33°C or 36°C. Primary outcomes were all-cause mortality and a composite score reflecting neurologic function at 180 days. A pre-established protocol was used at 72 hours for neurologic prognosis and withdrawal of care. At the end of the trial, 50% of the 33°C group

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had died, as compared to 48% of the 36°C group ($P = 0.51$). At the 180-day follow-up, 54% of the 33°C group had died or had poor neurologic function, compared with 52% in the 36°C group. No differences were identified in six predefined subgroups.

■ COMMENTARY

This well-done study was unable to show a benefit of TTM to 33°C as compared with 36°C. If two small studies were enough to change our management to TTM at 33°C, this larger, better-controlled study should make us consider returning to a goal of simply avoiding fever. Much has changed for the better in critical care management in the last 10 years. This may be partly why improved outcomes were seen in both treatment groups in this trial. TTM to 33°C, however, comes with its own set of complications, from the potential need for paralytics and pressors to increased resource utilization from the cooling

process. Changing to a philosophy of active fever avoidance rather than rapid cooling will be much easier to implement, with fewer side effects, and (based on this excellent study) equal outcomes.

I would hope for rapid modifications to the international guidelines and local practice to reflect the robust result of this study. Further studies may find subsets of patients who benefit from TTM to 33°C, but until then, 36°C should be our TTM goal. Remember: *Primum non nocere*: first, do no harm. ■

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ABSTRACT & COMMENTARY

Can Occurrence of Delirium be Predicted by Elevated Proinflammatory Cytokines?

By Linda L. Chlan, RN, PhD, FAAN

Dean's Distinguished Professor of Symptom Management Research, The Ohio State University, College of Nursing

Dr. Chlan reports that she receives grant/research support from Hospira.

SYNOPSIS: This observational study of 224 ICU patients who had serial measurements of C-reactive protein found an association between elevated initial levels and development of delirium. The authors also noted increased delirium incidence in patients whose levels increased on serial measurements.

SOURCE: Zhang Z, et al. Prediction of delirium in critically ill patients with elevated C-reactive protein. *J Crit Care* 2014;29:88-92.

Delirium, or acute confusion, is an unfortunate consequence of the ICU stay for many patients hospitalized for a critical illness or injury, occurring in up to 80% of patients depending on target population and assessment methods. In the past, delirium was viewed by clinicians as “something

that just happened to ICU patients.” However, findings from studies over the past few years have documented the adverse and detrimental influence of delirium on morbidity and mortality in critically ill patients. Numerous factors — including sepsis, metabolic factors, medications, illness severity, alcohol abuse,

older age, and inflammation that occurs with critical illness or infection — contribute to the occurrence of delirium. The study by Zhang and colleagues reviewed here aimed to determine if one proinflammatory cytokine, C-reactive protein (CRP), could be used as a predictor for the development of delirium in a sample of ICU patients in China.

A total of 223 patients (54.1% mechanically ventilated) were enrolled in this prospective, observational study from one 24-bed medical-surgical ICU. Patients had a Glasgow Coma Scale score of ≥ 10 , a Richmond Agitation Sedation Scale of -3 or higher, and were expected to remain in the ICU for a minimum of 48 hours. Patients with delirium at ICU admission or those with an acute brain injury (stroke, trauma, hemorrhage, or subdural hematoma) were not enrolled. Participants were predominantly male (63%) with a mean age of 57 years. Obtaining CRP levels is a standard of practice on this ICU; levels were obtained on ICU admission and 24 hours later. Nurses received training in administration of the Confusion Assessment Method-ICU, and performed all delirium assessments at ICU admission and every 8 hours each study day. Clinical variables (demographic data, medical diagnosis, illness severity [APACHE II], drinking and cigarette smoking history, application of physical restraints) were abstracted from the medical record. Analyses included change in CRP levels correlated with the clinical variables of illness severity, age, gender, intubation, history of drinking and smoking, use of physical restraints, and length of hospital stay.

The study participants had median APACHE II scores of 13 (inter-quartile range, 9-17), frequently had physical restraints applied (47.8%), with 26.1% known as heavy alcohol users and cigarette smokers. An overall prevalence of delirium was reported at 24.2%. Not surprisingly, delirium was more common in older, mechanically ventilated patients with higher illness severity scores and longer ICU stays. Higher levels of CRP were associated with delirium, in that for every 10 mg/mL increase in CRP from admission, there was a 7% increase in the risk for delirium. Further, patients with higher levels of CRP at ICU admission were more likely to develop delirium during the ICU stay, particularly in those with higher illness severity scores. The investigators concluded that elevated levels of CRP in patients with higher illness severity scores at ICU admission may be predictive of the occurrence of delirium during the ICU stay.

■ COMMENTARY

Delirium is an acute event that can fluctuate over the course of an ICU stay. It is complex and there are many clinical and patient-specific factors that are known contributors to this ICU-acquired syndrome. Likewise, inflammation is a very complex biological process that is confounded by critical illness, infectious processes, and medications. This makes it extremely difficult to single out one marker of inflammation given the complex interrelationships among the numerous pro- and anti-inflammatory biomarkers. Many times, these biomarkers exist in extremely miniscule amounts in the blood, while others may not even be detectable depending on the sensitivity and specificity of the assay. However, CRP is purported to be a non-specific biomarker of inflammation that increases 10,000-fold in response to stimuli, making it a strong candidate to investigate in the development of delirium when examining inflammatory processes.

Zhang and colleagues reported that changes in CRP from ICU admission resulting in higher levels of this proinflammatory cytokine during the ICU stay were predictive of the development of delirium, particularly in those patients who had higher illness severity scores. This finding is significant in that other investigators have attempted to link inflammatory biomarkers with the development of delirium — findings from these investigations have been inconsistent across studies. The significant findings by Zhang et al may be due to several factors, including expertise in obtaining and interpreting biomarkers (given CRP is routinely obtained for analysis in their ICU) and the careful selection of participants. Further, the investigators recommend serial measurement of CRP, given that changes toward higher levels of CRP were predictive of delirium development in their sample.

This study is limited in that only one proinflammatory cytokine was examined at two collection points. Given that other biomarkers are known to be associated with delirium, the findings from this study provide only a limited snapshot of the contributions of inflammatory biomarkers to the development of delirium. Further, inflammation can fluctuate over the course of critical illness, which supports the investigators' recommendation to obtain serial measurements of biomarkers over the course of ICU stay. Perhaps intervention strategies to prevent delirium are needed for all ICU patients, with special attention to those patients deemed to be at higher risk for the development of delirium given its significant impact on morbidity and mortality. ■

What Makes an ICU Consultation ‘High Quality’?

By *Leslie A. Hoffman, RN, PhD*

Professor Emeritus, Nursing and Clinical & Translational Science, University of Pittsburgh

SYNOPSIS: From interviews, seven key factors were identified that characterized a “high-quality consultation;” all could be easily adopted into critical care clinical practice.

SOURCE: Stevens JP, et al. Elements of a high-quality inpatient consultation in the intensive care unit. A qualitative study. *Ann Am Thorac Soc* 2013; 10:220-227.

Although consultation by specialists is common in the ICU setting, few studies have examined characteristics that make information provided from the consult more beneficial. In this study, one-on-one interviews were held with 12 attending physicians who provided care in ICUs of two academic medical center hospitals affiliated with Harvard Medical School. Participants (10 men, 2 women) had 12 ± 10 years’ experience at this institution (range, 1-30 years). They provided 24/7 coverage for three medical ICUs (77 beds) and covered the ICU and consults on weekends. All interviews were conducted by a single investigator using a semi-structured guide. Participants were asked open-ended questions about the mechanics of consultation and past positive and negative experiences. Interviews were audiotaped, transcribed, and coded for themes with discrepancies resolved by consensus.

Two qualities were viewed as influencing consult quality from the perspective of the requesting team, e.g., “articulating a clear question” and “conveying the level of urgency.” Seven characteristics were viewed as promoting high-quality input by the consulting team (*see Table*).

The identified elements focused on providing specific, helpful information in a timely manner and projecting a sense of interest in doing this. Barriers to a high-quality consult were in the majority the reverse, e.g., unclear question, delayed response, inability of the consultant to suggest a change without consulting his/her attending, etc. In addition, handoffs were identified as a barrier, given that the physician requesting the consult might be gone when the consultant arrived on the unit.

■ **COMMENTARY**

Consults are common in the ICU and inpatient setting. Among the Medicare population alone, data suggest that more than 12 million consults occurred in 2008 at a cost of \$1.9 billion. Reasons vary and include the need for assistance with a procedure, institutional protocol, and family request, as well as the need for expert opinion regarding a complex case. In addition, those interviewed for this study cited a desire to provide education to the primary care team and/or the consulting team as a reason for initiating a consult. Information provided in this study serves to highlight two important considerations on the part of the requesting team — to provide a clear rationale and clearly indicate the urgency of the

Requesting team	• Articulate a clear and concise question.
	• Tell the consulting team when you need the consultation quickly.
Consulting team	• Provide your assessment within the requested time.
	• Be decisive and provide a plan (for today and for follow-up).
	• Be thoughtful. Include new insights in the summary you offer for the case.
	• Recommend tests likely to change care, not a shotgun approach.
	• Project a high degree of helpfulness and interest in the case.
	• Engage with the family only with or after consultation with the primary team.
	• Provide an expert opinion. You have been called for your expert guidance.

request. Positive elements from the perspective of those providing the consult focused on the importance of decisiveness, responsiveness, professional behavior, and appropriate engagement with the family. Despite the range of subspecialty groups that were consulted by these ICU physicians, consistent themes emerged that could assist in providing more timely and helpful information. All were practical and should be easily implemented in practice.

■ EDITOR'S COMMENTARY

DAVID J. PIERSON, MD

Interesting information pertinent to the above study and discussion comes from a recently published article from Denver Health, a 500-bed university-affiliated urban safety-net hospital.¹ This study examined whether curbside consults — the common, informal hospital interactions in which clinicians seek advice about managing individual patients without formal assessments by the persons consulted — were accurate and complete. All 18 members of the Department of Medicine's Hospitalist Service carried out the study. Each time a curbside consult was requested, the hospitalist receiving the call proceeded with the telephone interaction as usual, documenting several aspects of the conversation and, afterwards, asking the consulting physician for permission to carry out a formal consultation on the patient addressing the issue that prompted the call. A different member of the hospitalist group then performed the formal consultation without knowledge of the details or advice provided, after which the two of them compared notes.

Later, an experienced senior clinician reviewed the interactions for accuracy, consistency, and agreement with his own assessment.

Formal same-day consultations were obtained for 47 of the 50 curbside consults requested during the study period. The requests came from many different services within the hospital, with psychiatry (47%) and the emergency department (19%) providing the most. Questions dealt with all aspects of diagnosis and management, and involved a wide spectrum of organ systems and presentations. Based on information collected in the formal consultation, information was either inaccurate or incomplete in 24 of 47 (51%) of the curbside consults. Management advice after formal consultation differed from that given in the curbside consult for 28 of 47 patients (60%). When inaccurate or incomplete information was received, the advice provided in the formal vs the curbside consultation differed in 22 of 24 patients (92%, $P < 0.0001$).

Although it was not carried out in a critical care setting, this study's findings should give pause to all hospital-based clinicians requesting curbside consultation in managing their patients. I would expect that the same characteristics described by Dr. Hoffman in the study by Stevens et al would apply, both for those requesting the consult and for those responding to the call. ■

REFERENCE

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ABSTRACT & COMMENTARY

Strategies for Implementing an ICU Early Mobility Program: Lessons From Leaders in the Field

By *Linda L. Chlan, RN, PhD, FAAN*

Dean's Distinguished Professor of Symptom Management Research, The Ohio State University, College of Nursing

SYNOPSIS: Leaders in progressive mobility programs for ICU patients offer their lessons learned and strategies to overcome barriers to help establish these programs on any ICU, including an interdisciplinary team with staff champions to maintain these important programs.

SOURCE: Engel HJ, et al. ICU early mobilization: From recommendation to implementation at three medical centers. *Crit Care Med* 2013;41:S69-S80.

A majority of ICU survivors experience weakness and impairments in cognitive, psychological, and physical functioning. A number of research studies have been

published over the past years documenting the positive benefits of early, progressive mobility interventions for ICU patients, including those receiving mechanical ventilatory support. These

benefits include less overall weakness, shorter ICU stays, less incidence of delirium, and improved cognitive and functional outcomes. The challenge for many ICUs has been how to implement an early, progressive mobility program. This abstract will summarize the key points emphasized in this article.

The article authors are leaders in the field of progressive mobility in the ICU from Johns Hopkins Hospital, Wake Forest University, and the University of California, San Francisco. The Plan-Do-Study-Act Quality Improvement (QI) framework was used to describe each medical center's progressive mobility programs.

- The *Planning Phase* is critical to get any QI project off the ground. All of the centers speak to the importance of an interdisciplinary team to begin planning the early mobility program. The inclusion of physical therapy is essential to establishing any progressive mobility program, as these professionals have the knowledge and skills needed for the interdisciplinary team. The minimum planning time reported by these programs was at least 1 year.
- The *Doing Phase* consists of data collection and analysis of both processes and outcomes that the unit desires as important QI indicators. Typical outcome measures include ventilator patient days, days until first out-of-bed experience, and ICU and hospital length of stay. It is imperative to gain widespread buy-in from all team and staff members, with support needed from administrators.
- Aspects of the *Studying Phase* need to allow for the consideration of barriers to the mobility program, as well as indicators of effectiveness, referrals to physical therapy, and cost effectiveness. Additional staff positions will be needed to safely and effectively establish and maintain any progressive mobility program. Regular meetings of the core interdisciplinary mobility team as well as regular updates for all staff are important aspects of this phase.
- The *Acting Phase* includes those strategies needed to sustain any new practice. This can be accomplished in a number of ways, including any necessary refinements to the protocol, frequent communication with staff, and standardization of the mobility program.

The authors include a daily mobility assessment and treatment algorithm that ICU clinicians may find useful to design and implement their own progressive mobility programs. Overall, the early mobility QI programs were found to be safe, with decreased ICU and hospital lengths of stay for a net cost savings.

■ COMMENTARY

Ever since the first evidence has emerged documenting the many benefits of progressive mobility for critically ill patients, ICU clinicians have been challenged to implement programs with their own patients. For many ICU clinicians, establishing and maintaining these programs can be daunting. The article by Engel and colleagues details how three leading medical centers established their progressive mobility QI programs. There is much for the reader to learn from these leaders, including what has worked in their respective ICUs and how those looking to establish a progressive mobility program can do so to meet the needs of their patients and staff members.

Common concerns of progressive mobility programs are patient safety and the risk for accidental extubation or removal of any invasive lines. Other concerns include enough manpower to implement progressive mobility, including ambulation of mechanically ventilated patients.

One of the most important contributions of this article is a presentation of barriers experienced and solutions surrounding their respective mobility QI projects. Identified barriers included a lack of leadership, staffing and equipment, knowledge and training, and physician referral for PT; over-sedation; delirium; patient hemodynamic intolerance of activity; and safety. Solutions presented included an interdisciplinary team, funding for additional staff, education and staff champions, alerts to physicians to order PT, education surrounding sedation practices, minimizing medications that promote delirium, protocols to promote patient tolerance for mobility, and interventions to promote safety such as close oversight of any IV and monitoring lines. These barriers and their solutions can be used by ICUs looking to establish their own progressive mobility programs to improve patient outcomes. ■

ABSTRACT & COMMENTARY

Quality of Critical Care Work Environment Linked to Fewer Health Care-Associated Infections

By *Leslie A. Hoffman, RN, PhD*

Professor Emeritus, Nursing and Clinical & Translational Science, University of Pittsburgh

SYNOPSIS: Nurses working in critical care environments that were perceived as more positive were less likely to report frequent health care-associated infections.

SOURCE: Kelly D, et al. The critical care work environment and nurse-reported health care-associated infections. *Am J Crit Care* 2013;22:482-489.

This study investigated the influence of the critical care work environment on nurse-reported health care-associated infections. Respondents were selected from nurses who participated in a survey by the American Hospital Association that included acute care hospitals in four states (New Jersey, Pennsylvania, California, and Florida). The sample for this study included 3217 critical care nurses working in 320 hospitals. Most (53%) had a bachelor's degree or higher, 54% were certified, and 11% were men. Mean nursing experience was 12.7 ± 11.1 years and the mean number of patients cared for was 2.2 ± 0.4 . The hospitals represented a wide range of bed size (< 250 to > 500); slightly more than half (54%) were teaching hospitals. Nurses were asked to rate the frequency of ventilator-associated pneumonia, catheter-associated bloodstream infections, and urinary tract infections on a 7-point Likert scale (never to every day). Infections were categorized as "frequent" if the event occurred more often than once a month. The Practice Environment Scale of the Nursing Work Index was used to assess work environment.

Results indicated that the odds of nurses who worked in hospitals with a better critical care work environment reporting frequent health care-associated infections were 36-41% lower than the odds for those who worked in worse nurse work environments.

■ COMMENTARY

The Centers for Disease Control and Prevention (CDC) estimates that each year approximately 1.7 million hospitalized patients will acquire an infection, and that 1 in 17 will die as consequence of the infection.¹ A substantial body of research supports that how nursing care is delivered influences the likelihood that patients will acquire an infection. Several factors, including high nurse

patient ratios, fewer hours of nursing care per patient-day, and nurse burnout have been linked to a greater frequency of acquired infections. A prior study by this research team reported that nurse burnout was significantly associated with a greater number of urinary tract and surgical site infections.¹ Hospitals in which burnout was reduced by 30% had fewer infections and an annual cost savings of up to \$68 million.¹

Findings of this recent study extend these results to the ICU environment. Scores on the instrument used for this study showed the most variability on ratings of nurse manager ability, leadership and support, staffing resources and support, nurse participation in hospital affairs, and collegial nurse-physician relations, suggesting that these are areas that can be investigated for improvement in perceptions of the work environment and, therefore, improved patient care. How perceptions of the work environment influence infection rates remains unclear. The authors hypothesize that detachment associated with high levels of burnout may result in inadequate hand hygiene practices and lapses in other infection control procedures. In addition, inadequate staffing and/or perceptions of limited nurse manager support can influence nurse commitment and, therefore, practice. Critical care nurses are sensitive to the amount of collaboration in the delivery of patient care and may hesitate to question if the attending physician or housestaff disregard their concerns. Evidence from this and other studies suggests that simple-to-implement changes can greatly impact the incidence of health care-associated infections and positively impact patient outcomes. ■

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CME/CNE Questions

1. How many patients were randomized in the study comparing 33°C with 36°C as a post-cardiac-arrest hypothermia target?
 - a. 200
 - b. 350
 - c. 500
 - d. 650
 - e. 950
2. In the study of therapeutic hypothermia following cardiac arrest, what percentage of patients in the 33°C group had died at the 180-day assessment point?
 - a. 18%
 - b. 33%
 - c. 54%
 - d. 71%
 - e. 89%
3. Based on the findings presented by Zhang and colleagues, which of the following statements is true about delirium?
 - a. C-reactive protein levels are predictive of the development of dementia.
 - b. Higher C-reactive protein levels were predictive of the development of delirium.
 - c. Cytokines do not contribute to neuroinflammation in critically ill patients.
 - d. Younger male patients who were heavy smokers had the highest occurrence of delirium.
 - e. None of the above
4. From the perspective of the requesting team, ways to increase the quality of an ICU consultation included:
 - a. initiating the consult early in the day.
 - b. requesting information from the family during the consult.
 - c. limiting consults for reasons not related to the case, e.g., good teaching example.
 - d. ensuring the person requesting the consult is available to provide case details.
 - e. stating a clear question and the urgency of the consult.
5. Which of the following statements is true for establishing a progressive mobility program?
 - a. Time is of the essence to preserve muscle strength of patients, necessitating protocols be established within 3 months.
 - b. Physicians should lead all progressive mobility teams.
 - c. An interdisciplinary group of ICU professionals should be established during the Planning Phase.
 - d. Establishing a progressive mobility team should be accomplished within available staff resources that exist on the unit.
 - e. None of the above
6. ICU nurses who worked in environments that were rated more positively:
 - a. were significantly older.
 - b. had more years of nursing experience.
 - c. related their nurse manager more positively.
 - d. reported participating in rounds that included family members.
 - e. reported that health care-associated infections occurred less often.

CME/CNE Objectives

Upon completion of this educational activity, participants should be able to:

- identify the particular clinical, legal, or scientific issues related to critical care;
- describe how those issues affect physicians, nurses, health care workers, hospitals, or the health care industry; and
- cite solutions to the problems associated with those issues.



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