Evidence-Based Practice

Fever Evaluation and Early Recognition of Systemic Inflammatory Response Syndrome in Critical Care Patients

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Fever is very often the first sign of sepsis and systemic inflammatory response syndrome, both of which can be life-threatening. This article presents various guidelines for the treatment and prevention of fever using evidence-based practice guidelines from a variety of sources.

Keywords: Evidence-based practice, Fever, Sepsis, Systemic inflammatory response syndrome

Evidence-based practice (EBP) is the conscientious integration of best research evidence with clinical expertise and patient values and needs in the delivery of quality, cost-effective healthcare. Evidence-based practice is now the criterion standard for both medicine and nursing in defining guidelines for the evaluation of fever and the signs of systemic inflammatory response syndrome (SIRS). Critical care nurses use protocols and order sets to monitor, report, and treat fever. Physicians and nurses must collaborate in the intensive care unit (ICU) to work toward a common goal for their patients.

Fever is a common complaint in hospitalized patients, with estimates that more than 30% of ward patients and as many as 90% of critically ill patients will experience fever defined as a temperature greater than the normal body temperature, usually higher than 38°C.1

Body temperature and fever are considered indicators of infection. Measurement methodology is important when obtaining, monitoring, and reporting accurate temperatures. Noninvasive measurements (oral, axillary, tympanic) are more accessible than core temperatures (pulmonary artery catheters, bladder, esophageal, or rectal). Oral and temporal artery measurements were the most accurate and precise.2 Tympanic ear measurements were least accurate and precise of the noninvasive measurements. Oral and axillary measurements are slightly lower than pulmonary artery core temperature, whereas tympanic temperature was slightly higher. The National Guideline Clearinghouse (NGC), initiated by the Agency for Healthcare Research and Quality in 1998, recommends that no axillary, temporal, or chemical dot temperatures be obtained in the ICU.3

Measurement methodology is important when obtaining, monitoring, and reporting accurate temperature.

The first question that must be asked when caring for a critically ill patient who is febrile is whether to treat the fever.4 Research studies have shown that fever is the body’s natural defense mechanism but increases cardiovascular demands and metabolic rates. Fever can be detrimental for the patients with neurological disorders and cardiac arrest because tissue damage and perfusion are increased. Continued hypothermia management now is their treatment option, and fever is deferred. A patient’s clinical findings and condition determine when and how the patient is treated.4
Fever is 1 of the 4 signs of SIRS. The Institute for Healthcare Improvement (IHI) proposed definitions for a systemic inflammatory response to a variety of severe clinical insults and is characterized by 2 or more of the following conditions:

(a) temperature higher than 38°C or lower than 36°C
(b) heart rate higher than 90 beats/min
(c) respiratory rate higher than 20 breaths/min or PaCO₂ lower than 32 mm Hg
(d) white blood cell counts higher than 12,000 cells/μL or lower than 4,000 cells/μL, or the presence of more than 10% immature neutrophils (band cells).

Systemic inflammatory response syndrome is the precursor to sepsis, which can be averted or treated when early recognition and treatment are implemented by the nurse or physician. One of 4 patients presenting with infection/sepsis worsens to severe sepsis or shock. Untreated sepsis leads to multiple organ dysfunction syndrome, increased length of stay, increased hospital costs, and increased mortality.

**PROBLEM**

Nurses need to discard the belief that fever is harmful and must be treated without recognizing the cause. Each febrile patient should be assessed and treated individually without a cookie-cutter or quick-fix approach. Critical-thinking skills and assessment of overall systems, invasive lines, medications, indwelling drainage catheters, pain, incision(s), vital signs, and pulse oximetry must be done prior to treatment with antipyretics, cold washcloths, ice packs, and hyperthermia units. Additional factors should be considered, including patient population, supporting clinical signs and symptoms, and the patient’s medical history. Innovative new therapies that prevent shivering and associated cardiovascular stress are also being evaluated.

Nurses need to be familiar with current research findings and recommendations for best practice. The advanced practice nurse is uniquely capable of gathering this evidence and implementing a plan of care that meets the individual needs of the patient, family, nursing staff, and healthcare system.

**PERSONAL AND PROFESSIONAL INTEREST**

As a critical care nurse since 1974 and certified as a critical care nurse since 1982, there have been numerous patients exhibiting signs of SIRS that went unrecognized and/or mistreated. Various treatment modalities have been used in my career before the advent of EBP. Appropriate antibiotic use, surgical control of infection sources, and timely fluid resuscitation before the development of organ damage are essential to resolve SIRS and prevent progression to sepsis. There must be interest in the prevention of SIRS before the patient becomes septic. The NGC developed guidelines that include an outline with specific interventions to use with patient care and procedures.

Goals to provide a professional approach are to continue to act as a role model, patient advocate, resource person, and educator. The nurse must also act as a cheerleader for EBP, NGC, and IHI recommendations; Joint Commission standards; Magnet Hospital Program managed by the American Nurses Credentialing Center; and the American Association of Critical-Care Nurses (AACN) Synergy Model. Synergy results when the needs and characteristics of a patient or clinical unit or system are matched with a nurse’s competencies. The AACN Synergy Model for Patient Care was developed to link clinical practice with patient outcomes. Emphasis is that the patient is priority and comes first. The AACN promotes certification that contributes to outcomes, quality of care, and containment of costs. Levels of expertise range from competent (1) to expert (5) and incorporate clinical judgment, collaboration, system thinking, learning facilitation, and clinical inquiry. Experiential knowledge and evidence-based guidelines improve questioning and evaluating EBP.

**EVALUATION QUALITY OF PRACTICE GUIDELINE**

Guidelines for evaluation of new fever in critically ill adult patients were chosen from the NGC Web site. The authors of this guideline are the American College of Critical Care Medicine and the Infectious Disease Society of America. This guideline was updated in 2008 from previous versions from 1998 Clinical Infectious Disease and Critical Care Medicine journals. The task force members provided personal experience and determined the published literature (MEDLINE articles, textbooks, etc) from which consensus was obtained. Published literature was reviewed and classified into 1 of 4 categories, according to study design and scientific value. This guideline is physician-driven, which is all-inclusive for various causes of infection and sepsis. Other sites such as AACN, IHI, Centers for Disease Control and Prevention, and Agency for Healthcare Research and Quality support research findings from 2008 to present, from this guideline. These guidelines were a product of systematic review, rigorous quantitative scientific research, meta-analysis, and collaboration from various specialties such as obstetrics, pulmonary medicine, infectious diseases, internal medicine, neurology, oncology, surgery, and critical care.
Fever Evaluation and Early Recognition of SIRS

**CURRENT BEST EVIDENCE OF THE PROTOCOL FOR FEVER AND SEPSIS**

Fever in a patient in the ICU necessitates several nursing tasks. Best evidence drives the nursing care procedures and protocols. Fever was an independent predictor for patients in the ICU to receive further tests and treatments. The NGC recommends obtaining blood cultures followed with empiric antibiotics, complete blood count, chest radiograph, and serum procalcitonin levels (PCT) and performing endotoxin activity assay. Endotoxemia was detected in no more than half of patients with gram-negative bacteremia. Various research studies also obtaining recommend C-reactive protein and PCT levels. C-reactive protein and PCT are equally effective, although not perfect, in differentiating between sepsis and noninfectious SIRS. Neopterin is very useful in the diagnosis of viral infection and is released in noninfectious inflammatory diseases as well as sepsis.

The current best evidence in protocol is the NGC guideline for treating new fever in critical care patients. Guideline developers and committee members include the Infectious Diseases Society of America–Medical Specialty Society and the Society of Critical Care Medicine–Professional Association. There is a need to determine via analysis of the literature the best evidence-based approach to the identification and treatment of fever with attention to appropriate measurement of body temperature, diagnostic evaluation, changing of indwelling catheters, administration of antipyretics, and alteration in antimicrobial therapy.

**EBP AND PRACTICE**

Presently, many of the NGC guidelines and EBP are placed into practice with the ICU/critical care unit standing order sets. A temperature of 38.3°C has come to be the threshold value that typically triggers diagnostic fever evaluation for bacteremia in hospitalized patients.

Parameters for obtaining blood cultures and portable chest radiograph are listed. Manifestation of fever in general ICU patients is an independent predictor of nursing workload at the patient level. Patient care needs associated with basic activities, ventilatory support, metabolic support, neurological support, and specific interventions are higher in febrile patients than in nonfebrile patients. The sister hospital within our system is now testing the sepsis bundle. Their outcomes will influence the development of suspected sepsis standing order sets with the addition of PCT and endotoxin assay levels.

The need for EBP and standardized best practice care is a good fit for the ICU. The increasing number of clinical procedures and more complex technology used in the ICU and the patients’ clinical characteristics and signs and symptoms remain important predictors of nursing intensity. Level V (>1-2 different populations or situations) or level VI (variety of populations and situations) clinical studies of the research-based practice protocols are recommended by the AACN to evaluate the usefulness of research. Research-based protocols are user-friendly for both nurses and physicians.

**IMPLEMENTING GUIDELINES AND COST FACTORS**

New guidelines, protocols, standing order sets, policies, and procedures must endure submission to various committees and medical review boards before implementation. Committees and review boards are multidisciplinary. Ideally, all decisions about treatment of fever would be based on results of well-developed research studies. Cost factors include education of staff and physicians, procurement of supplies, development of new forms or computerized documentation screens, equipment updates, and increasing staffing needs to facilitate EBP implementation. New guidelines require data collection and monitoring to document compliance of new protocols, which increases nursing hours.

Evidence related to the treatment of fever is evaluated by using the recommendation levels of the research-based practice protocols of the AACN. More extensive workups include urinalysis, blood and urine cultures, complete blood counts with differentials, and chest radiographs, which are the standard of ICU care. Some research studies report that 90% of fever morbidity is attributed to noninfectious causes. False-positive blood culture results in annualized costs of $1.4 to $1.8 million and added an estimated 1,450 to 2,200 extra hospital days per year.

But initial increased costs can be justified if reduced lengths of stays and complications are reduced. Through implementation of EBP and through systems thinking, EBP for the febrile patient can simultaneously reduce nosocomial infection–related morbidity and mortality, reduce healthcare spending, slow the increase in antibiotic-resistant bacteria, and positively impact the system as a whole. Interventions that can help reduce ICU length of stay, ICU mortality, and overall hospital mortality are performance improvement measures that outweigh the costs.
■ OUTCOME MONITORING
Concurrent data collection and chart audits are important outcome monitoring tools done by nursing staff, managers, educators, clinical nurse specialists, and quality improvement teams. Retrospective chart review is suitable for advanced improvement teams or teams that have demonstrated success with concurrent data collection. Using this strategy, teams identify charts for monthly review with the assistance of the health information services department based on discharge diagnoses such as sepsis (International Classification of Diseases, Ninth Revision [ICD-9] codes 038.9 and 038.47), SIRS (ICD-9 codes 995.92, 996.64, and 999.3), septic shock (ICD-9 code 785.52), or other appropriate diagnoses.11 Outcome monitoring recommended by the IHI includes blood cultures, fluid resuscitation, and antibiotic timing. Other goals and factors to be monitored are (1) low-dose steroid administration, (2) glycemic control, (3) central venous pressure, (4) central venous oxygen saturation, (5) drotrecogin alfa (activated protein C) administration, and (6) inspiratory pressure. The results of the retrospective chart review will help determine success or deficiency of the EBP protocol effort.

■ STANDARDIZED GUIDELINE OR ALGORITHM
Evaluation of new fever in the critically ill patient is the main guideline. The fever nursing assessment and sepsis bundles are crucial as well. The fever nursing assessment coincides with this guideline. Sepsis bundles are implemented, pending the results of the fever evaluation.

The Fever Nursing Assessment Guideline12 is relatively simple and straightforward, which can be taught to critical care nurses. Their Web site provides a step-by-step question checklist to evaluate the following:

• Fever Nursing Assessment Guideline12

Whenever a resident has a temperature greater than 100°F (oral/tympanic) or greater than 101°F (rectally), an evaluation should be completed before a decision is made to treat with nursing measures and as-needed (PRN) medications or to call the provider on call (Table 1).

Guidelines for the evaluation of new fever in critically ill adult patients are from the Task Force of the Society of Critical Care Medicine and the Infectious Disease Society of America.

• NGC guidelines for evaluation of new fever in critically ill adult patients

The NGC developed guidelines for the evaluation of a new fever in critical ill patients (Table 2). There are 3 levels: (1) level 1 is convincingly justifiable on scientific evidence alone; (2) level 2 is reasonably justifiable by available scientific evidence and strongly supported by expert critical care opinion; and (3) level 3 is for which adequate scientific evidence is lacking but widely supported by available data and expert critical care opinion. Guidelines represented on the NGC Web site are submitted by guideline developers and are screened solely to determine that they meet the NGC inclusion criteria, which may be found at http://www.guideline.gov/about/inclusion.aspx.

The site of temperature measurement should be recorded with the temperature in the chart.
### TABLE 2  NGC Guidelines for Evaluation of New Fever

#### Major Recommendations

**Recommendations for measuring temperature**

1. Choose the most accurate and reliable method to measure temperature based on the clinical circumstances of the patient. Temperature is most accurately measured by an intravascular, esophageal, or bladder thermostat, followed by rectal, oral, and tympanic membrane measurements, in that order. Axillary measurements, temporal artery estimates, and chemical dot thermometers should not be used in the intensive care unit (ICU) (level 2). Rectal thermometers should be avoided in patients with neutropenia (level 2).

2. Any device used to measure temperature must be maintained and calibrated appropriately, using the manufacturer’s guidelines as a reference (level 2).

3. Any device used to measure temperature must be used in a manner that does not facilitate spread of pathogens by the instrument or the operator (level 2).

4. The site of temperature measurement should be recorded with the temperature in the chart (level 1).

5. A new onset of temperature of greater than or equal to 38.3°C is a reasonable trigger for a clinical assessment but not necessarily a laboratory or radiological evaluation for infection (level 3).

6. A new onset of temperature of less than 36.0°C in the absence of a known cause of hypothermia (eg, hypothyroidism, cooling blanket) is a reasonable trigger for a clinical assessment but not necessarily a laboratory or radiological evaluation for infection (level 3).

7. Critical care units could reduce the cost of fever evaluations by eliminating automatic laboratory and radiological tests for patients with new temperature elevation (level 2). Instead, these tests should be ordered based on clinical assessment. A clinical and laboratory evaluation for infection, conversely, may be appropriate in euthermic or hypothermic patients, depending on clinical presentation.

**Recommendations for obtaining blood cultures**

1. Obtain 3 to 4 blood cultures within the first 24 h of the onset of fever. Every effort must be made to draw the first cultures before the initiation of antimicrobial therapy. They can be drawn consecutively or simultaneously, unless there is suspicion of an endovascular infection, in which case separate venipunctures by timed intervals can be drawn to demonstrate continuous bacteremia (level 2).

2. Additional blood cultures should be drawn thereafter only when there is clinical suspicion of continuing or recurrent bacteremia or fungemia or for test of cure, 48-96 h after initiation of appropriate therapy for bacteremia/fungemia. Additional cultures should not be drawn as a single specimen but should always be paired (level 2).

3. For patients without an indwelling vascular catheter, obtain at least 2 blood cultures using strict aseptic technique from peripheral sites by separate venipunctures after appropriate disinfection of the skin (level 2).

4. For cutaneous disinfection, 2% chlorhexidine gluconate in 70% isopropyl alcohol is the preferred skin antiseptic, but tincture of iodine is equally effective. Both require >30 s of drying time before proceeding with the culture procedure. Povidone iodine is an acceptable alternative, but it must be allowed to dry for >2 min (level 1).

5. The injection port of the blood culture bottles should be wiped with 70%-90% alcohol before injecting the blood sample into the bottle to reduce the risk of introduced contamination (level 3).

6. If the patient has an intravascular catheter, 1 blood culture should be drawn by venipuncture, and at least 1 culture should be drawn through an intravascular catheter. Obtaining blood cultures exclusively through intravascular catheters yields slightly less precise information than information obtained when at least 1 culture is drawn by venipuncture (level 2).

7. Label the blood culture with the exact time, date, and anatomic site from which it was taken (level 2).

8. Draw 20 to 30 mL of blood per culture (level 2).

9. Paired blood cultures provide more useful information than single blood cultures. Single blood cultures are not recommended, except in neonates (level 2).

10. Once blood cultures have been obtained after the onset of new fever, additional blood cultures should be ordered based on clinical suspicion of continuous or recurrent bacteremia or fungemia (level 2).

**Recommendations for management of intravascular catheters**

1. Examine the patient at least daily for inflammation or purulence at the exit site or along the tunnel, and assess the patient for signs of venous thrombosis or evidence of embolic phenomena (level 2).

2. Any expressed purulence from the insertion site should be Gram stained and cultured (level 2).

3. If there is evidence of a tunnel infection, embolic phenomenon, vascular compromise, or septic shock, the catheter should be removed and cultured and a new catheter inserted at a different site (level 2).

4. With short-term temporary catheters—peripheral venous catheters, noncuffed central venous catheters, or arterial catheters—if catheter-related sepsis (ie, source of the infection is a colonized catheter) is considered likely, the suspect catheter or catheters should be removed and a catheter segment cultured. Blood cultures should be obtained as well. With all short-term catheters, a 5- to 7-cm intracutaneous segment should be cultured to document the source of bacteremia; with short peripheral venous or arterial catheters, the tip should be cultured; with longer central venous catheters, the intracutaneous segment and tip should be cultured; and with pulmonary artery catheters, the introducer and the pulmonary artery catheter should be cultured (level 1).
5. At least 2 blood cultures should be obtained. At least 1 blood culture should be obtained peripherally by venipuncture. One specimen should be obtained from the suspected catheter (level 1). If a quantitative culture system is available, it should be used to diagnose the catheter as the source of bacteremia/ fungemia. Alternatively, differential time to positivity can be used if both blood cultures are positive for the same organism. The distal port is the logical port from which to draw cultures. When short-term, uncuffed central venous catheters are suspected of infection, it is usually more efficient to remove the existing catheter and replace it than to draw quantitative cultures (level 2).

6. Do not routinely culture all catheters removed from ICU patients. Culture only those catheters suspected of being the source of infection (level 2).

7. It is not necessary to routinely culture infused specimens as part of the evaluation for catheter-related infections, unless there is clinical suspicion for infected infusate or blood products (level 2).

**Recommendations for evaluation of pulmonary infections**

If a febrile patient is suspected of having a lower respiratory tract infection by clinical or radiographic assessment:

1. A chest imaging study should be obtained. In most cases, an upright portable anteroposterior chest radiograph is the most feasible study to obtain. Posterior-anterior chest radiographs with lateral view or computed tomography (CT) scan offer more information and should be obtained when clinically indicated, especially to rule out opportunistic infections in immunocompromised patients (level 1).

2. Obtain 1 sample of lower respiratory tract secretions for direct examination and culture before initiation of or change in antibiotics. Expectorated sputum, induced sputum, tracheal secretions, or bronchoscopic or nonbronchoscopic alveolar lavage material can be used effectively. If pneumonia is documented by physical examination and radiographic evaluation, a decision to use bronchoscopy or other invasive diagnostic approaches should be considered based on an individual basis and the availability of local expertise (level 2).

3. Respiratory secretions obtained for microbiological evaluation should be transported to the laboratory and processed in <2 h (level 2).

4. Respiratory secretions that are judged to be appropriate samples by the laboratory should be evaluated by gram-negative stain and cultured for routine aerobic and facultative bacteria. Additional stains, rapid tests, cultures, and other tests should be performed as epidemiologically appropriate (level 2).

5. Quantitative cultures can provide useful information in certain patient populations when assessed in experienced laboratories; however, quantitative cultures have not yet been sufficiently standardized, nor have they been shown to alter outcome for this technique to be considered part of routine evaluation (level 2).

6. Pleural fluid should be obtained with ultrasound guidance for gram-negative stain and routine culture (with other studies as clinically indicated) if there is an adjacent infiltrate or another reason to suspect infection and the fluid can be safely aspirated (level 2).

**Recommendations for evaluation of the gastrointestinal tract**

If more than 2 stools per day conform to the container in which they are placed in a patient at risk for *Clostridium difficile* and if clinical evaluation indicates that a laboratory evaluation is necessary:

1. Send 1 stool sample for *C difficile* common antigen, enzyme immunoassay (EIA) for toxin A and B, or tissue culture assay (level 2).

2. If the first specimen for *C difficile* is negative and testing is performed by an EIA method, send an additional sample for *C difficile* EIA evaluation. A second specimen is not necessary if the common antigen test was negative (level 2).

3. If severe illness is present and rapid tests for *C difficile* are negative or unavailable, consider flexible sigmoidoscopy (level 3).

4. If severe illness is present, consider empirical therapy with vancomycin while awaiting diagnostic studies. Empirical therapy is not generally recommended if 2 stool evaluations are negative using a reliable assay. Although it may be more cost-effective than making the diagnosis, the empirical use of antibiotics, especially vancomycin, is discouraged because of the risk of producing resistant pathogens (level 2).

5. Stool cultures for other enteric pathogens are rarely indicated in a patient who did not present to the hospital with diarrhea or in patients who are not HIV infected. Send stool cultures for other enteric pathogens and examine for ova and parasites only if epidemiologically appropriate or evaluating an immunocompromised host (level 2).

6. Test stool for norovirus if the clinical and epidemiological setting is appropriate. Testing for norovirus is usually available only in state laboratories and is usually performed in outbreak settings. Obtain consultation with infection control and public health authorities (level 3).

**Recommendations for evaluation of the urinary tract**

1. For patients at high risk for urinary tract infection (kidney transplant patients, granulocytopenic patients, or patients with recent urological surgery or obstruction), if clinical evaluation suggests that a patient may have symptomatic urinary tract infection, a laboratory evaluation is necessary. Obtain urine for microscopic examination, gram-negative stain, and culture (level 2).

2. Patients who have urinary catheters in place should have urine collected from the sampling port of the catheter and not from the drainage bag (level 2).

3. Urine should be transported to the laboratory and processed within 1 h to avoid bacterial multiplication. If transport to the laboratory will be delayed for >1 h, the specimen should be refrigerated. Alternatively, a preservative could be used but is less preferable to refrigeration (level 2).
### TABLE 2 continued

**Major Recommendations**

<table>
<thead>
<tr>
<th>Recommendations for evaluation of the sinuses</th>
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<tbody>
<tr>
<td>1. If clinical evaluation suggests that sinusitis may be a cause of fever, a CT scan of the facial sinuses should be obtained (level 2).</td>
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<tr>
<td>2. If the patient has not responded to empirical therapy, puncture and aspiration of the involved sinuses under antiseptic conditions should be performed (level 2).</td>
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<tr>
<td>3. Aspirated fluid should be sent for gram-negative stain and culture for aerobic and anaerobic bacteria and fungi to determine the causative pathogen and its antimicrobial susceptibility (level 1).</td>
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**Recommendations for evaluation of fever within 72 h of surgery**

| 1. A chest radiograph is not mandatory during the initial 72 h postoperatively if fever is the only indication (level 3). |
| 2. A urinalysis and culture are not mandatory during the initial 72 h postoperatively if fever is the only indication. Urinalysis and culture should be performed for those febrile patients having indwelling bladder catheters for >72 h (level 3). |
| 3. Surgical wounds should be examined daily for infection. They should not be cultured if there is no symptom or sign suggesting infection (level 2). |
| 4. A high level of suspicion should be maintained for deep venous thrombosis, superficial thrombophlebitis, and pulmonary embolism, especially in patients who are sedentary, have lower limb immobility, have a malignant neoplasm, or are taking an oral contraceptive (level 2). |

**Recommendations for evaluation of surgical site infection**

| 1. Examine the surgical incision at least once daily for erythema, purulence, or tenderness as part of the fever evaluation (level 2). |
| 2. If there is suspicion of infection, the incision should be opened and cultured (level 2). |
| 3. Gram-negative stain and cultures should be obtained from any expressed purulence obtained from levels within the incision consistent with a deep incisional or organ/space surgical site infection. Tissue biopsies or aspirates are preferable to swabs (level 3). |
| 4. Drainage from superficial surgical site infections may not require gram-negative stain and culture because incision, drainage, and local care may be sufficient treatment and antibiotic therapy may not be required. Superficial swab cultures are likely to be contaminated with commensal skin flora and are not recommended (level 2). |
| 5. Standard guidelines should be used to define burn wound infection (level 3). |

**Recommendations for evaluation of central nervous system infections**

| 1. If altered consciousness or focal neurological signs are unexplained, lumbar puncture should be considered in any patient with a new fever, unless there is a contraindication to lumbar puncture (level 3). |
| 2. For a patient with a new fever and new focal neurological findings suggesting disease above the foramen magnum, an imaging study is usually required before lumbar puncture. If a mass is present, neurology/neurosurgery consultation is required to determine the optimal diagnostic approach (level 2). |
| 3. In febrile patients with an intracranial device, cerebrospinal fluid (CSF) should be obtained for analysis from the CSF reservoir. If CSF flow to the subarachnoid space is obstructed, it may be prudent to also obtain CSF from the lumbar space (level 3). |
| 4. In patients with ventriculostomies who develop stupor or signs of meningitis, the catheter should be removed and the tip cultured (level 3). |
| 5. CSF should be evaluated by gram-negative stain and culture, glucose, protein, and cell count with differential. Additional tests for tuberculosis, viral and fungal disease, neoplasia, etc., should be performed as dictated by the clinical situation (level 2). |

**Recommendation for using biomarkers to determine the cause of fever**

1. Serum procalcitonin levels and endotoxin activity assay can be used as an adjunctive diagnostic tool for discriminating infection as the cause for fever or sepsis presentations (level 2).

**Recommendations for recognizing noninfectious causes of fever**

1. Consider all new medications and blood products that the patient has received. Ideally, if the suspected drug can be stopped, do so. If the drug cannot be stopped, consider a comparable substitute (level 2).
**TABLE 2 continued**

**Major Recommendations**

2. Fever induced by drugs may take several days to resolve. Establishing a temporal relationship between fever and the offending agent may be helpful in establishing the diagnosis (level 3).

**Recommendations for empiric therapy of fever**

1. When clinical evaluation suggests that infection is the cause of fever, consideration should be given to administering empirical antimicrobial therapy as soon as possible after cultures are obtained, especially if the patient is seriously ill or deteriorating (level 1).

2. Initial empirical antibiotic therapy should be directed against likely pathogens, as suggested by the suspected source of infection, the patient risk for infection by multidrug-resistant pathogens, and local knowledge of antimicrobial susceptibility patterns (level 1).

- **Sepsis Management Bundle**

  When 2 or more signs of SIRS are presented, the sepsis bundle should be initiated. The sepsis bundles have specific time-related guidelines and will substantially reduce mortality. The 2004 practice guidelines are recommended by the Surviving Sepsis Campaign (SSC). The SSC is the first initiative of its kind to bring together 3 leading professional organizations in the field of sepsis: the European Society of Intensive Care Medicine, the Society of Critical Care Medicine, and the International Sepsis Forum. The purpose of the SSC is to create an international collaborative effort to improve the treatment of sepsis and reduce the high mortality rate associated with the condition. The SSC Web site provides background information on sepsis, identifies individuals who are at risk, provides treatment options, and features a special section for healthcare professionals.11 Severe sepsis bundles have been designed to allow teams to follow the timing, sequence, and goals of the individual elements of care, to achieve the goal of a 25% reduction in mortality from severe sepsis.11,13,14

  The Severe Sepsis Resuscitation Bundle describes 7 tasks that should begin immediately but must be accomplished within the first 6 hours of presentation for patients with severe sepsis or septic shock. Some items may not be completed if the clinical conditions described in the bundle do not prevail in a particular case, but clinicians must look for them. The goal is to perform all indicated tasks 100% of the time within the first 6 hours of identification of severe sepsis.

  The Sepsis Management Bundle lists 4 management goals. Efforts to accomplish these tasks should also begin immediately, but these items may be completed within 24 hours of presentation for patients with severe sepsis or septic shock.

**CONCLUSION**

The NGC reflects the 2008 update from the American College of Critical Care Medicine and the Infectious Disease Society of America. The fever assessment, new fever evaluation, and sepsis bundle guidelines all promote EBP for best practice care, improved patient outcomes, and decreased length of stay for the critical care patient.

Because nursing is implementing medical guidelines, collaboration between the physician and nurse is vital for positive outcomes and implementation of physician orders. Collaboration involves direct and open communication, respect for different points of view, and mutual responsibility for problem solving.12 The advanced practice nurse not only needs to approach each febrile patient individually but also needs to be cognizant of the current literature regarding treatment of fever and of the impact his/her actions have on the global healthcare system.

**References**


Call for Manuscripts

If you are a critical care nurse, nurse educator, nurse manager, nurse practitioner, clinical nurse specialist, researcher, other healthcare professional, or knowledgeable about topics of interest to critical care nurses, Dimensions of Critical Care Nursing would like to hear from you.

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