

Fever Evaluation, Complication and Treatment in Surgical Patients

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Abstract: Fever following surgery is a common event occurring in 14%-91% of postoperative patients. Fever can occur immediately after surgery and seen to be related directly to the operation or may occur sometime after the surgery as a result of complication related to surgery. Although the list of causes of postoperative fever is extensive, the initial focus for most patients should be on a limited number of the more common infectious and noninfectious causes. The classic W5 of postoperative fever are as follows: Wind: atelectasis on postoperative day 1-2, Water: urinary tract infection on postoperative day 2-3, Wound: wound infection on postoperative day 3-7, Walking: deep venous thrombosis/thrombophlebitis on postoperative day 5-7, and Wonder Drug: drug fever on postoperative day >7. Postoperative fever evaluations should take into account numerous factors including timing, the patient's own medical, surgical, and social history, as well as details of the procedure including significant events comprising the patient's preoperative, intraoperative, and postoperative period. A focused physical assessment and any additional symptoms the patient is experiencing should be taken into account in evaluating the clinical significance of a postoperative fever and determining appropriate action. Treatments for the postoperative fever are all dependent on the etiology. Thus, identifying the likely cause through a thorough patient history and physical examination becomes critical.

Keywords: Fever, Surgery, Postoperative Period

1. Introduction

Fever is the abnormal elevation in body temperature which results from a disturbance of the thermoregulatory mechanism [Asgar Pour & Yavuz, 2014]. According to Society of Critical Care Medicine and The Infectious Disease Society of America fever is defined as an increase in core body temperature $\geq 38.3^{\circ}\text{C}$. Fever following surgery is a common event occurring in 14%-91% of postoperative patients. Most fevers that develop within the first 48 hours after surgery are benign [Asgar Pour & Yavuz, 2014; Pile, 2006]. Fever can occur immediately after surgery and seen to be related directly to the operation or may occur sometime after the surgery as a result of complication related to surgery. Most cases of fever immediately following surgery are self-limiting. For greater temperature increases, evaluation of postoperative fever can entail a lengthy differential diagnosis that must be narrowed by the

interpretation of available data [Baid et al., 2014; Burke, 2010; Dindo et al., 2004]. So, during evaluation of postoperative fever, it is important to recognize when a wait-and-see approach is appropriate, when further work-up is needed and when immediate action is indicated [Mermel et al., 2009; Ryan M, Levy 2003].

2. Pathophysiology of Postoperative Fever

Fever is a manifestation of cytokine release in response to a variety of stimuli. Fever-associated cytokines, including interleukin (IL)-1, IL-6, tumor necrosis factor (TNF)-alpha, and interferon (IFN)-gamma, are produced by a variety of tissues and cells. Fever-associated cytokines are released by tissue trauma and do not necessarily signal infection. The magnitude of the trauma is correlated with the degree of the

febrile response [Asgar Pour & Yavuz, 2010]. The febrile response is stimulated by the release of intracellular messengers known as cytokines. Cytokines may be released in response to exogenous pyrogens such as microorganisms or endogenous pyrogens released as a result of tissue trauma such as that which occurs during surgery [Rudra et al., 2006]. The primary activator of the febrile response is a cytokine known as interleukin I. Cytokines stimulate the release of prostaglandins from the anterior hypothalamus, and the prostaglandins are then responsible for acting to reset the thermoregulatory center, thereby causing a rise in the temperature set point that manifests as a fever [Perlino, 2001]. It has been established that the greater the magnitude of tissue trauma or manipulation, the greater the release of cytokines and increased incidence of fever. This has been demonstrated by increased episodes of postoperative fever after open vs. laparoscopic cholecystectomy [Rudra et al., 2006]. Regardless of the type of surgery, some degree of tissue trauma and cytokine release is an expected consequence of surgery. This is precisely why fever can be such a complicated finding in a postoperative patient as it can be difficult to ascertain whether it is a normal response to the tissue trauma of surgery or whether it is the first sign of a more serious infectious process that may be occurring [Asgar Pour & Yavuz, 2010; Lesperance et al., 2011].

3. Early Postoperative Fever

During the first few hours after surgery a drop in body temperature depend on a continuation of intraoperative hypothermia caused by interference with the hypothalamic thermoregulatory mechanism by general anesthesia. So, related of this hypothermia shivering observed as the body attempts to regain control of its set point [Asgar Pour & Yavuz, 2010; Sikora & Embil, 2004]. Early postoperative fevers are usually due to the inflammatory response to surgery and are not associated with infections. In contrast, fevers due to infection tend to occur later in the postoperative period. Fevers in the early postoperative period (< 24 h) are most often due to the normal inflammatory response to surgery. In the presence of a high fever, a bedside assessment of the wounds is mandatory. Treatment of fever in a noninfected patient should focus on returning the thermoregulatory setpoint to normal with antipyretics [Lesperance et al., 2011; Ryan & Levy, 2003].

4. Postoperative Fever Related on Time Period of Surgery

A discussion of postoperative fever must take into account the time period relative to the day of surgery. A differential diagnosis can then be formulated. The classic “Ws” of postoperative fever are as follows: Wind: atelectasis on postoperative day 1-2; Water: urinary tract infection on postoperative day 2-3; Wound: wound infection on postoperative day 3-7; Walking: deep venous

thrombosis/thrombophlebitis on postoperative day 5-7; and Wonder Drug: drug fever on postoperative day>7 [Asgar Pour, 2012].

Fevers on postoperative days 1-2 are usually due to atelectasis induced by general anesthesia and decreased diaphragmatic excursion. Incentive spirometry, coughing, deep breathing, chest physiotherapy, and adequate pain control all help to prevent and treat atelectasis. Fevers on postoperative days 3-7 are more likely to be due to infectious causes than fevers occurring at other times. Risk factors which predispose patients to postoperative infections include diabetes, immune suppression, obesity, catheterization (urinary, peripheral or central venous), and prolonged postoperative ventilation [Asgar Pour, 2012; Ryan & Levy 2003; Sikora & Embil 2004]. Tenderness, erythema, drainage, and inflammation at the surgical wound are all indicators of possible wound infection. Prolonged ventilation or persistent atelectasis predisposes patients to pneumonia. Other causes of fever in the later postoperative period include central line sepsis, deep venous thrombosis/pulmonary embolism, intrabdominal abscess, anastomotic leak, clostridium difficile colitis, and parotitis. In the absence of identifiable infections, drug fevers should be considered [Mermel et al., 2009; Saavedra et al., 2008].

5. Factors Related on Postoperative Fever

The timing of fever after surgery is one of the most important factors to consider in generating a prioritized differential diagnosis of postoperative fever. The timing of postoperative fever can be usefully described as immediate, acute, subacute and delayed. The potential causes of fever in the immediate operative and postoperative period are mainly limited to medications or blood products in preoperative or intraoperative period and rarely malignant hyperthermia. Fever due to the trauma of surgery usually resolves within two to three days. The severity and duration of these self-limited postoperative fevers depends on the type of surgery, but tends to be greater in patients with longer and more extensive surgical procedures [Lesperance et al., 2011]. There are many causes of fever in the first week after surgery. Nosocomial infections are common during this period. Acute fever can also be caused by noninfectious conditions. Surgical trauma, hematoma / seroma, drugs used, transfusion reactions, pulmonary embolism, deep vein thrombosis, infarct, intestinal ischemia, endocrine causes, cancer, organs in transplant rejection, atelectasis, pancreatitis, thrombophlebitis, alcohol withdrawal, and acute gout can complicate the acute postoperative period [Jonathan et al., 2008]. Surgical site infection (SSI) is a common cause of fever more than one week after surgery. Patients who require critical care after surgery are at higher risk for the development of subacute fever [Mermel et al., 2009]. These patients typically develop a variety of postoperative complications. Nosocomial infections are more common in

these patients because of their treatment with invasive medical devices. Most delayed postoperative fevers are due to infection. Viral infections from blood products, including cytomegalovirus, hepatitis viruses, and human immunodeficiency virus, can arise late in postoperative patients [Rudra et al., 2006].

6. Causes of Postoperative Fever

Although the list of causes of postoperative fever is extensive, the initial focus for most patients should be on a limited number of the more common infectious and noninfectious causes [Asgar Pour, 2012]. Aspiration pneumonia, clostridial myonecrosis and necrotizing infections due to group A Streptococcus may occur as the cause of fever at this early postoperative period. Especially surgical site infections, urine tract infection and intravascular catheter-associated infection are the most common infectious causes of postoperative fever. Nosocomial bacterial and fungal pathogens are usually implicated. The infecting microorganisms generally are found as endogenous flora of the skin or bowel, but the flora change as patients are hospitalized for longer periods and receive antimicrobial therapy. Viral infections in the postoperative patient are usually associated with the transfusion of blood products. Noninfectious causes of postoperative fever include underlying conditions that are unmasked by the stress of surgery. Other causes to be considered are medication (Antibiotics: penicillin, cephalosporins, vancomycin, sulfonamides, rifampicin, amphotericin B; Cardiovascular drugs: thiazide diuretics, spironolactone, hydralazine, quinidine and other drugs: heparin, calcilylates, nonsteroidal anti-inflammatory, allopurinol), immunoglobulins, malignant hyperthermia, inflammation, gout pancreatitis, fat embolism, cardiovascular and stroke, transfusion reaction, hyperthyroidism or thyroid storm and neuroleptic malignant syndrome [Jonathan et al., 2008; O'Grady et al., 2008].

7. Diagnostic Approach to Postoperative Fever

A thorough differential diagnosis of postoperative fever includes infectious and noninfectious conditions that occur following surgery [Asgar Pour, 2012]. Fever occurring within two postoperative days does not need investigation beyond clinical assessment. Surgical trauma is responsible for more than 70% of early postoperative fever episodes. In evaluating a postoperative patient with fever, it is important to consider a broad differential, and not to assume that fever is due to infection [Lorente et al., 2007; Ryan M, Levy 2003].

Postoperative fever evaluations should take into account numerous factors including timing, the patient's own medical, surgical, and social history, as well as details of the procedure including significant events comprising the patient's preoperative, intraoperative, and postoperative course. In addition, a focused physical assessment and any

additional symptoms the patient is experiencing should be taken into account in evaluating the clinical significance of a postoperative fever and determining appropriate action. While a complete blood count evaluating leukocyte count may be the first indication of an infectious process and is commonly evaluated in the postoperative patient daily [Rudra et al., 2006].

8. History and Physical Examination of Febrile Patients in Postoperative Period

Elsewhere, atelectasis and medications are identified as causes of postoperative fever. In addition to gaining information about the patient's past medical history, type of surgery, and events of their hospitalization, a focused physical examination is necessary as it may also reveal the etiology of postoperative fever. Much of the physical examination and consequent evaluation will be guided by each patient's particular symptoms. And based on the results of the physical examination and the patient's symptoms, this will guide the diagnostic studies that need to be carried out to definitively diagnose many of the causes of postoperative fever [Perlino, 2001]. A comprehensive history should be taken and a physical examination performed. Vascular access sites, drains, and hardware should be examined. A chest radiograph is easily obtained in the ICU and worthwhile in many patients with respiratory symptoms or signs. It may detect a new or progressive pulmonary infiltrate, distinguish pneumonia from tracheobronchitis, and identify a respiratory source of fever other than pneumonia or tracheobronchitis. A computed tomography scan may be more useful for clarifying abnormal chest radiographic findings. Abdominal imaging is indicated for patients with symptoms or signs of an intraabdominal process, those who have undergone recent abdominal surgery, and those whose laboratory tests suggest a possible intraabdominal process [Pile 2006; Ryan & Levy 2003].

9. Complications and Treatment of Postoperative Fever

Fever can have detrimental effects, especially in severely ill patients. It increases sympathetic tone, resting energy expenditure, and oxygen consumption, all of which increase cardiac pulmonary workload. As mentioned, temperatures over 40°C, can cause nervous system injury, and posttraumatic elevation of temperature is associated with increased inflammatory processes [Asgar Pour, Yavuz 2014].

Treatments for the postoperative fever are all dependent on the etiology. Each fever should be carefully evaluated and the more dangerous etiologic causes ruled out. Thus, identifying the likely cause through a thorough patient history and physical examination becomes critical. The focused fever evaluation should emphasize a basic physical exam and patient history aimed at identifying risk factors for

infection. In the low risk patient with fever within 72 h of surgery, no additional laboratory, culture, or radiographic evaluation is necessary unless directed by clinical findings [Lesperance et al., 2011]. It is probably appropriate to suppress the fever in most patients with one or two days of scheduled acetaminophen to minimize patient discomfort and the physiologic stress and metabolic demands of fever and shivering. This approach is unlikely to mask a significant pathologic condition. Additional treatment depends upon the cause of the fever. The use of antipyretic agents is discouraged until the cause of the fever has been determined or at least until a major pathologic condition has been ruled out [Dindo et al., 2004; Mermel et al., 2009]. The decision to administer antibiotics to a patient with postoperative fever depends upon careful clinical assessment including an appraisal of the patient's stability. Antibiotic therapy should be initiated at the appropriate time [O'Grady et al., 2008]. Patients who have undergone major surgery and are receiving intensive care and patients with hemodynamic instability generally should be treated empirically with broad-spectrum antibiotics after cultures have been obtained. If a site of infection is identified, the broad-spectrum regimen should be focused to cover the probable or known causative organisms. Antimicrobial treatment beyond the empiric period of 48 hours should be reserved for patients in whom an infection has been identified. Carefully selecting antimicrobial treatment can help to avoid adverse medication reactions and can help to minimize the prevalence of resistant organisms in the hospital [Lorente et al., 2007; Rudra et al., 2006].

If fever develops in the second day after surgery if the patient's medical and surgical history should be evaluated. Atelectasis will improve with time, although incentive spirometer may speed the process. The patient's breathing should be monitored and deep breathing exercises should be performed four times per hour. Patients semi-fowler (30-45°) should be in position and breathing exercise 10 times per hour spirometry should do after waking up patient [Mermel et al., 2009; Sikora & Embil 2004]. Urine cultures are

positive in up to 30% of postoperative patients with a urinary bladder catheter in situ. Any unnecessary treatments, including medications and catheters, should be discontinued in patients with postoperative fever. If fever develops on 3-5 days after surgery, the patient should be evaluated for urinary tract infection symptoms. If the catheter is inserted it should be removed as soon as and ensured adequate hydration. The catheter care must be made in accordance with the principles of aseptic. However, as positive urine cultures are associated with sepsis in only 10% of patients, antibiotics should be used only after other causes of fever are ruled out. Removing the offending invasive device and treating the infection with appropriate antibiotics solves catheter-related infections. Developed fever 4-6 days after surgery, lower extremities sensitization should be checked for redness and pain. Homans sign should be considered for patients and bed leg exercises should be done. Anticoagulant therapy should be started immediately [Lesperance et al., 2011; Saavedra et al., 2008].

Thrombophlebitis can often be treated with warm compresses and anti-inflammatory agents, however, if signs and symptoms of infection are present, appropriate antibiotics must be used [Sikora and Embil, 2004]. If fever develops on 5-7 days of surgery, the patient should be evaluated for preoperative infection and other underlying disease. In addition, the patient's weight, laboratory values and the integrity of the skin in the area to do the surgery should be considered. Postoperative care must be done carefully and patient should be evaluated in terms of symptoms and signs of infection [Saavedra et al., 2008; Sikora & Embil, 2004].

Wound infection is the second most common hospital-acquired infection. Replacing the dressing should be done in accordance with aseptic technique and culture of the incision site should be taken if necessary. Subcutaneous abscesses are diagnosed by the presence of erythema, pus and tenderness of the surgical incision. Fascia and muscle can be involved. Deeper infections need early resuscitation, surgical debridement and antimicrobial therapy [Cohen et al., 2010].

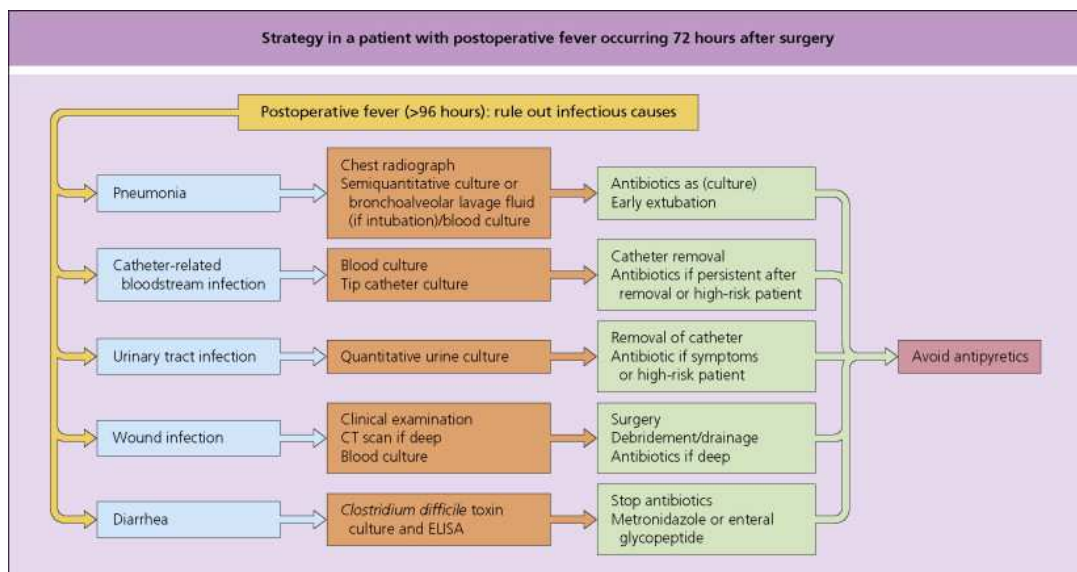


Figure 1. Strategies in patients with postoperative fever.

10. Conclusion

Postoperative fever, is a natural response to trauma to the body mechanism also occur for other reasons. Fever is a defense mechanism in the body. In case of infection it occurs as a symptom of pre-development. It also inhibits the proliferation of the microorganisms by activation of the immune system. Although the fever's beneficial effects on the patient, the treatment is very important to avoid harmful effects. Fever can be causes the degradation of the amino acids found in muscle, weight loss, an increase of calcium mobilization in bone; urine calcium, amino acids and albumin increased; tachycardia, cardiac and coronary insufficiency development; convulsions; delirium; reduction in arterial blood pressure and SaO₂ and increase in heart rate. Routine workup for early postoperative fever of low clinical yield adds cost. Treatment of the underlying disease prevents postoperative fever. Postoperative evaluation of the general condition of the patient is important in the prevention of complications. Selection of appropriate treatment to reduce the fever is important. Treatment of the underlying disease to prevent fever after surgery, as well as the assessment of the overall condition of the patient after the surgery, it is important in the prevention of complications. A rational approach is required for new or persistent fever arising more than 3 days after surgery (Figure 1).

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