Fever in the Postoperative Patient

Mayur Narayan, MD, MPH, MBA[a,b,*], Sandra P. Medinilla, MD, MPH[c]

KEYWORDS

• Fever • Inflammation • Atelectasis • Urinary tract infection • Pneumonia
• Necrotizing soft-tissue infection • Intra-abdominal abscess • *Clostridium difficile*

KEY POINTS

- Postprocedure fevers vary in the timing of their occurrence, duration, and severity.
- Such fevers do not all have an infectious cause, but they all require thorough investigation to rule out life-threatening conditions.
- This article summarizes the principles of diagnosis and management of postprocedure fevers for the emergency care provider.

INTRODUCTION

The emergence of fever, defined as a temperature greater than 38°C (100.4°F), during the perioperative time course can present a diagnostic and management challenge for the emergency medical care provider.[1] Infectious and noninfectious causes of the fever must be distinguished. Infectious causes should be considered mainly for fever presenting later than 48 hours after surgery, whereas early postoperative fever is most commonly attributed to noninfectious causes.[2] Others have stated that noninfectious causes appear to cause lower-temperature fevers (<38.9°C [102°F]), whereas a higher temperature should raise concern for an infectious cause.[3] Despite these claims, the cause of postprocedure fever is often not identified despite the rigorous efforts of clinicians. The classic "Ws" of postoperative fever (**Table 1**), long taught to medical students as mantra, have been challenged recently.[4]

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[a] Department of Surgery, Center for Injury Prevention & Policy, R Adams Cowley Shock Trauma Center, University of Maryland School of Medicine, 22 South Greene Street, Baltimore, MD 21201, USA; [b] Program in Trauma, Center for Injury Prevention & Policy, R Adams Cowley Shock Trauma Center, University of Maryland School of Medicine, 22 South Greene Street, Baltimore, MD 21201, USA; [c] Department of Surgery, Christiana Care Health Services, 4735 Ogletown-Stanton Road, Medical Arts Pavilion II, Suite 3301, Newark, DE 19713, USA
* Corresponding author. Department of Surgery, Center for Injury Prevention & Policy, R Adams Cowley Shock Trauma Center, University of Maryland School of Medicine, 22 South Greene Street, Baltimore, MD 21201.
E-mail address: mnarayan@umm.edu

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Table 1
Classic "Ws" of postoperative fever

W	Cause	Timing
Wind	Atelectasis	POD 1–2
Water	Urinary tract infection	POD 2–3
Wound	Wound infection	POD 3–7
Walking	Deep vein thrombosis/thrombophlebitis	POD 5–7
Wonder drug	Drug fever	POD >7

Abbreviation: POD, postoperative day.
Data from Cline D, Stead LG. Abdominal emergencies. New York: McGraw Hill; 2007.

The causes of postprocedural fever range from inflammation or drug reaction to life-threatening necrotizing soft-tissue infection (NSTI). As with all medical diagnoses, a thorough history and physical examination should serve as the diagnostic starting point in ascertaining relevant information in terms of exposure to infectious pathogens. In addition, the timing of fever after a procedure can help differentiate potential causes. It is therefore useful to divide the time frame of postprocedure fever into 4 categories: immediate, acute, subacute, and delayed. Fevers that occur in the first 4 days after surgery are less likely to represent infectious complications than are fevers occurring on the fifth and subsequent days (**Fig. 1**). Fever can also accompany the continuum of systemic inflammatory response, sepsis, severe sepsis, and septic shock (**Table 2**).

The time of emergence of postprocedure fever can guide the provider's differential diagnosis and, thus, management decisions. In a prospective study of 81 patients with idiopathic postoperative fever, Garibaldi and colleagues[2] found that 80% of those with fever on the first postoperative day had no infection. Within the group in whom fever developed by the fifth postoperative day, 90% had an identifiable source such as wound infection (42%), urinary tract infection (UTI) (29%), or pneumonia (12%).[2,5] Dellinger[6,7] showed that early fevers (ie, emerging between days 1 and 4) rarely represent an infection. However, a fever that begins on or after postprocedure day 5 is much more likely to represent a clinically significant infection, so appropriate diagnostics to look for an infectious source may be useful. These tests can include laboratory investigations (blood culture, urine cultures, complete blood counts) and images (plain

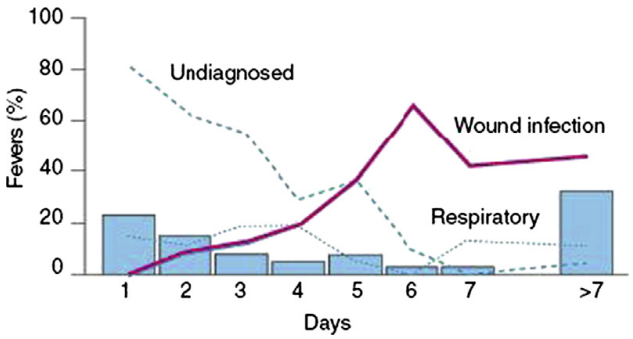

Fig. 1. Percentage of postoperative fevers occurring on the indicated day following an operative procedure. Lines indicate the percentage of fevers occurring on each day attributable to the cause indicated. (*From* Dellinger EP. Approach to the patient with postoperative fever. In: Gorbach S, Bartlett J, Blacklow N, editors. Infectious diseases. Philadelphia: Lippincott Williams & Wilkins; 2004. p. 817–23; with permission.)

Table 2
Definition of sepsis

Term	Definition
SIRS[a]	Body temperature ≥38 C or <36 C Heart rate >90 beats/min Respirations >20/min or $Paco_2$ <32 mm Hg White blood cell count >12.0 × 10^9/L or <4.0 × 10^9/L
Sepsis	SIRS plus infection
Severe sepsis	Sepsis associated with organ dysfunction, systemic hypoperfusion, or hypotension
Septic shock	Sepsis with arterial hypotension despite adequate fluid replacement

[a] At least 2 parameters are needed to meet the criteria for the systemic inflammatory response syndrome (SIRS).

Adapted from Bone RC, Balk RA, Cerra FB, et al. Definitions for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis. The ACCP/SCCM Consensus Conference Committee. American College of Chest Physicians/Society of Critical Care Medicine. Chest 1992; 101:1644–55.

films, computed tomography [CT]). In this period, vigilance for occult infection should be maintained.[5]

INFLAMMATION AND HEALING

Immediate postoperative fever (occurring during the procedure or up to 1 hour following it) is most commonly caused by inflammatory changes from the release of pyrogenic cytokines, primarily interleukin (IL)-1, IL-6, tumor necrosis factor, and interferon-γ. These mediators increase capillary permeability and are central elements of the inflammatory response and, thus, healing.[8] The cytokines act directly on the anterior hypothalamus and cause a release of prostaglandins, which mediate the febrile response.[5] Studies have shown that IL-6 levels correlate directly with the magnitude of fever in patients undergoing a Whipple procedure (**Fig. 2**).[9]

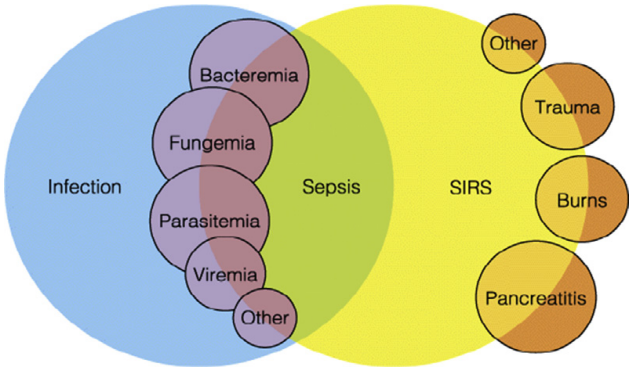

Fig. 2. Relationship of Infection, SIRS, Sepsis, Severe Sepsis, and Septic Shock. The diagram depicts the relationships between SIRS and infection. Note that only when SIRS occurs with an infection does sepsis or septic shock occur. For definitions of SIRS, Sepsis, Severe Sepsis, and Septic Shock, please see **Table 2**. (*Data from* Wheeler AP, Bernard GD. Treating patients with severe sepsis. N Engl J Med 1999;340(3):207–14; and Bone RC, Balk RA, Cerra FB, et al. Definitions for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis. The ACCP/SCCM Consensus Conference Committee. American College of Chest Physicians/Society of Critical Care Medicine. Chest 1992;101(6):1644–55.)

Frank and colleagues[10] found that the mean time to maximum temperature elevation in patients who underwent vascular, abdominal, and thoracic surgeries was 11 hours. Blood concentrations of IL-6 correlated with fever elevation. The severity of the procedure, in terms of the extent of tissue trauma, can also influence the fever curve. For example, laparoscopic cholecystectomy is associated with fewer episodes of postoperative fever than an open approach.[11] The amount of tissue trauma seems to have a causal relationship with the release of IL-6 and thus to the development of fever. Inflammation secondary to cytokine release is now thought to be the most common cause of immediate postprocedure fever. For most patients, the fever resolves and a benign course can be expected.[2,5,12–14]

In the immediate postprocedure period, routine measurement of temperature followed by a detailed laboratory or diagnostic workup is not warranted as long as the patient is hemodynamically stable. Diagnostic tests, such as blood or urine cultures, should not be ordered routinely during this period. Patient physiology should drive diagnostic decision making in this phase. A prospective triple-blind study involving 308 consecutive patients found that measuring postoperative body temperature was of limited value in the detection of infection after elective surgery for noninfectious conditions.[15]

In the past, atelectasis was thought to be a common cause of postprocedure fever; however, numerous studies have shown that it is not clearly related to fever. Roberts and colleagues[16] evaluated 270 patients who had undergone elective abdominal surgery, and reported the presence of fever in 40%. When fever was defined as a temperature of 37.7°C (99.9°F) or higher, chest-film evidence of atelectasis was found in 57% of febrile patients. However, when the threshold for fever was raised to at least 38.0°C (100.4°F), only 47% of patients had atelectasis.

Engoren[17] showed that the incidence of atelectasis increased as the incidence of fever decreased with each successive postoperative day. Atelectasis was associated with neither the presence nor the severity of fever. Vermeulen and colleagues[15] reviewed the records of 284 general surgery patients, who had 2282 temperatures taken. Fever (temperature $\geq$38°C) was noted in 61 patients, and infection was found in 7 (11.5%). Infection was diagnosed in 12 of 223 patients (5.4%) without fever. As a predictor of infection, a temperature of 38°C had sensitivity of only 37% and specificity of 80%, a likelihood ratio of a positive test of 1.8, and a likelihood ratio of a negative test of 0.8%. The positive predictive value of each individual temperature was only 8%.

Other common causes of immediate postprocedural fever include reactions to medication and transfusions, the presence of infection before the procedure, fulminant surgical-site infection, trauma, and adrenal insufficiency.

EMERGENT CAUSES OF EARLY POSTOPERATIVE FEVER

Several causes of early postoperative fever warrant special mention: NSTI/myonecrosis, pulmonary embolism, alcohol withdrawal, anastomotic leak, adrenal insufficiency, and malignant hyperthermia. These potentially life-threatening conditions mandate early diagnosis followed by prompt intervention.

Necrotizing Soft-Tissue Infections

NSTIs are invasive and potentially lethal if not evaluated, diagnosed, and treated promptly. NSTIs can manifest as necrotizing fasciitis, clostridial gas gangrene, Fournier gangrene, and invasive streptococcal cellulitis.[18] Although NSTIs are not common, they confer high risk; therefore, it is important to ensure that the diagnostic

workup is adequate to exclude them. The time to presentation for NSTIs has significant variability. Presentations might occur particularly early, often within hours to days of the initial procedure.[18] Therefore, a posture of suspicion toward the classic clinical signs of NSTI is particularly important, that is, "dishwater drainage," erythema, edema, induration, bullae, and pain out of proportion to examination findings.

The pathogen can be introduced from hematogenous spread from distant sites of infection, minor trauma, or surgical incisions.[18,19] Fournier gangrene can be caused by colorectal or genitourinary surgical intervention. Other potential sources include intramuscular injections, odontogenic infections, or surgery.[20,21] Infection can be worsened by many risk factors such as vascular disease, impaired cellular immunity, diabetes mellitus, alcohol abuse, obesity, malnutrition, and the use of nonsteroidal anti-inflammatory drugs (NSAIDs).[18,22] All of these risk factors are very common among postoperative patients.

Commonly cultured organisms include Group A hemolytic streptococci, enterococci, coagulase-negative staphylococci, *Staphylococcus aureus*, *Staphylococcus epidermidis*, and clostridial species.[18] In the emergency setting, particularly severe cases can present with signs of systemic inflammation (tachycardia and fever) and even with evidence of end-organ dysfunction (eg, confusion, hypotension). Clinically the presence of subcutaneous gas on plain radiographs or CT should raise suspicion of NSTI and prompt early action. Early consultation with a surgical service is necessary, given that definitive diagnosis and treatment both require operative interventions (debridement, collection samples for pathologic evaluation, and confirmatory diagnosis). Clayton and colleagues[23] reported that the detection of gas on a radiograph had sensitivity of 39%, specificity of 95%, and a positive predictive value of 88% for NSTI. Scoring systems, such as the Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score (**Table 3**), have been developed to assist in diagnosis. Patients with an LRINEC score of greater than 6 on admission should be evaluated carefully; hospitalization, surgical assessment, and close monitoring are recommended.[24]

Prompt surgical consultation, in addition to administration of appropriate antibiotics and intravascular volume resuscitation, is imperative.[25,26] Broad antibiotic coverage should be initiated, covering gram-positive, gram-negative, and anaerobic organisms. Commonly used regimens include a penicillin (vancomycin in penicillin-allergic patients), clindamycin or metronidazole, and an aminoglycoside (or a third-generation cephalosporin or aztreonam).[18] Clindamycin should be administered to inhibit streptococcal toxins. Clinicians caring for these patients must remain watchful for signs of clinical deterioration. Patients who require large amounts of fluid resuscitation might develop pulmonary edema and subsequent respiratory failure requiring ventilatory support. Early surgical source control is the mainstay of management. When debridement begins early in the course of illness, defined as less than 24 hours after presentation, the morbidity and mortality rates are significantly diminished.[22,27]

Pulmonary Embolism

Murray and colleagues[28] found fever (temperature >38°C) attributed solely to acute pulmonary emboli in 57% of their series of 35 patients, whereas fever with no other definite or possible explanatory cause was observed in 14% of the 311 patients in the Prospective Investigation of Pulmonary Embolism Diagnosis (PIOPED) study. In general, fever associated with pulmonary embolism is of low grade (temperature rarely exceeding 38.3°C [101°F]) and short-lived, peaking the same day on which the pulmonary embolism occurs and gradually disappearing within 1 week. Septic thrombophlebitis can lead to septic pulmonary emboli, causing a high postprocedural temperature (**Fig. 3**).[29]

Table 3
Variables in the LRINEC score for diagnosing necrotizing soft-tissue infection

Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) Score	
Variable	**Score**
C-reactive protein (mg/L)	
<150	0
≥150	4
Total white cell count (per mm^3)	
<15	0
15–25	1
>25	2
Hemoglobin (g/dL)	
>13.5	0
11–13.5	1
<11	2
Sodium (mmol/L)	
≥135	0
<135	2
Creatinine (μmol/L)	
≤141	0
>41	2
Glucose (mmol/L)	
≤10	0
>10	1

Key: low risk (≤5 points), intermediate risk (6 or 7 points), and high risk (≥8 points). Internal validation revealed that a cutoff of ≥6 had a positive predictive value of 92% and a negative predictive value of 96%. Scores ≥8 were strongly suggestive of necrotizing soft-tissue infection (positive predictive value 93.4%).

Data from Wong CH, Khin LW, Heng KS, et al. The LRINEC (Laboratory Risk Indicator for Necrotizing Fasciitis) score: a tool for distinguishing necrotizing fasciitis from other soft tissue infections. Crit Care Med 2004;32:1535–41.

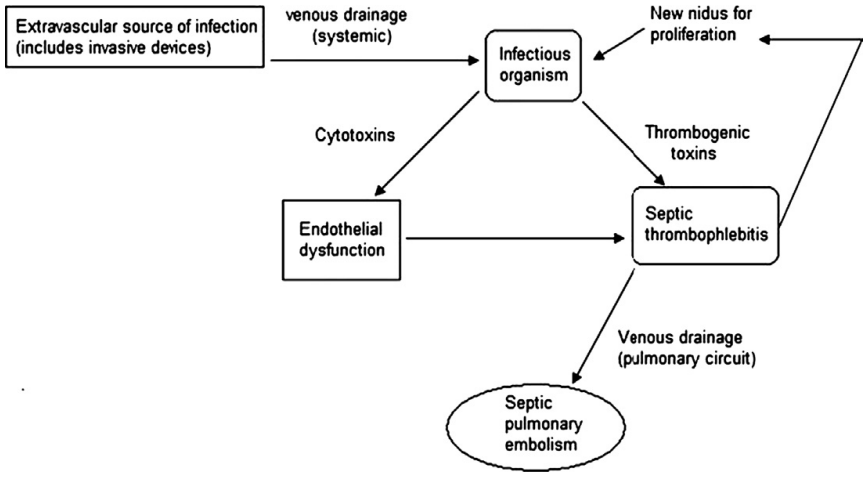

Fig. 3. Possible pathophysiologic mechanisms of septic pulmonary embolism in the setting of septic thrombophlebitis. (*From* Brenes JA, Goswami U, Williams DN. The association of septic thrombophlebitis with septic pulmonary embolism in adults. Open Respir Med J 2012;6:14–9; with permission.)

Anastomotic Leak/Intra-Abdominal Abscess

It is important to remember that abscesses can form after any type of surgical procedure. Patients presenting to the emergency department for evaluation of fever and abdominal pain after an intra-abdominal procedure should be presumed to have a surgical complication such as anastomotic leak. When the abdominal compartment is contaminated, an abscess may form. Patients can present with symptoms of frank peritonitis, including abdominal pain, nausea, and vomiting. The time lag between surgery and presentation can vary from 1 week to several months. Peritoneal contamination can occur during any interventional, endoscopic, laparoscopic, robotic, or open procedure. The bowel can be injured inadvertently when the peritoneum is entered; for example, with the trocar used during laparoscopy. Patients with prostatic and perinephric infections and abscesses can also present with fever and abdominal pain, but these are retroperitoneal abscesses. After diagnosis, prompt surgical consultation for source control should be obtained. Treatment with broad-spectrum antibiotics should be initiated after specimens for culture are obtained.[30]

Alcohol Withdrawal

Fever can be an occult sign of withdrawal symptoms in alcoholics. Manifestations of alcohol withdrawal vary from simple tremulousness to the most dramatic and severe form, delirium tremens, with its attendant fever, confusion, hallucinations, agitation, and overactivity of the autonomic nervous system. Patients who are in withdrawal from alcohol can present with simultaneous infections of the respiratory and urinary tracts. In some of them, no cause of infection is ever identified. Otero-Antón and colleagues[31] found no infectious cause of fever in one-third of patients with alcohol withdrawal syndrome. Febrile patients in withdrawal impose an especially difficult scenario on the emergency physician because of the vast array of potential causes of the fever and their typically unreliable and uncooperative manner (**Table 4**).[32]

Patients in alcohol withdrawal require aggressive medical treatment and observation. Benzodiazepines, such as diazepam or lorazepam, should be used liberally for sedation and delirium. The dosage should be based on validated tools, such as the Clinical Institute Withdrawal Assessment for Alcohol Scale (CIWA-Ar).[33] Patients at greater risk for adverse outcomes might require intubation and ventilatory support. Frequent assessment of the patient's progress is mandatory to determine whether medication doses should be adjusted.[34]

Table 4
Causes of fever among the types of alcohol withdrawal syndrome

	Anxiety and Tremor (n = 10)	Delirium (n = 38)	Seizures (n = 62)
Catheter-associated phlebitis	4 (40)	17 (45)	18 (29)
Urinary tract infection	0	6 (16)	5 (8)
Respiratory infection	1 (10)	8 (21)	6 (10)
Miscellaneous	0	1 (3)	2 (3)
Pyrexia of unknown cause	4 (40)	9 (24)	25 (40)

Data are presented as absolute numbers, with percentages in parentheses. Percentages have been approximated to the entire values.

From Otero-Antón E, González-Quintela A, Saborido J, et al. Fever during alcohol withdrawal syndrome. Eur J Intern Med 1999;10:112–6; with permission.

Adrenal Insufficiency

Acute adrenocortical insufficiency is a life-threatening condition that should always be in the early differential diagnosis of postprocedural fever. Undiagnosed or untreated, it can lead to severe rates of morbidity and mortality. The diagnosis can be challenging, because many of the presenting signs and symptoms are nonspecific. For instance, a postoperative fever might be treated presumptively as infection or systemic inflammatory response syndrome when it actually is a subtle indicator of adrenal insufficiency.[35]

Adrenal insufficiency is either primary or secondary. Primary adrenal insufficiency can result from glandular destruction or metabolic failure. Causes of glandular destruction include, but are not limited to idiopathic atrophy, hemorrhage, tuberculosis, fungal infection, and other diseases infiltrating the adrenal glands. Metabolic failure leads to insufficient hormone production, and usually results from either congenital adrenal hyperplasia, enzyme inhibitors, or autoimmune adrenal insufficiency caused by cytotoxic T lymphocytes. Secondary adrenal insufficiency, more common than the primary form, can result from hypopituitarism associated with hypothalamic-pituitary disease, or from suppression of the hypothalamic-pituitary axis by exogenous steroids or endogenous steroids, such as a tumor.[36,37]

Adrenal crisis can result from an acute exacerbation of chronic insufficiency, usually caused by sepsis or surgical stress. Acute adrenal insufficiency also can be caused by adrenal hemorrhage, classically from septicemia-induced Waterhouse-Friderichsen syndrome (fulminant meningococcemia) and anticoagulation complications. Steroid withdrawal is the most common cause of acute adrenocortical insufficiency, and almost always leads to a glucocorticoid deficiency. Aggressive supportive management should be initiated promptly, beginning with the ABCs of resuscitation (airway, breathing, circulation). Electrolyte abnormalities and hypoglycemia should be corrected. Hydrocortisone, 100 mg intravenously every 6 hours, and fludrocortisone acetate (mineralocorticoid), 0.1 mg daily, should be administered. The key management principle is treatment of the underlying problem that precipitates the crisis.[38]

Malignant Hyperthermia

Malignant hyperthermia, a life-threatening clinical syndrome of hypermetabolism, has been known to occur after the administration of inhalational anesthetic agents, muscle relaxants such as succinylcholine, and other drugs. It occurs in susceptible individuals who have abnormal regulation of calcium in skeletal muscle. This defect allows large quantities of calcium to be released from the sarcoplasmic reticulum of skeletal muscle, causing a hypermetabolic state. The hypermetabolic response leads to increased production of carbon dioxide, metabolic and respiratory acidosis, accelerated oxygen consumption, heat production, activation of the sympathetic nervous system, hyperkalemia, disseminated intravascular coagulation, and multiorgan dysfunction and failure.[39] Early clinical signs of malignant hyperthermia include a rapid, exponential increase in end-tidal carbon dioxide, muscle rigidity, tachypnea, tachycardia, hyperkalemia, and fever. Unrecognized, it can lead to myoglobinuria, subsequent multiorgan failure, and death. Early diagnosis, supportive care with ventilatory and circulatory support, and treatment with dantrolene can improve the outcome.[40]

OTHER CAUSES OF POSTOPERATIVE FEVER

Urinary Tract Infection

UTIs are the most common hospital-acquired infections, and are associated with indwelling catheters in 80% to 90% of cases.[30,41] Patients at highest risk are those

with prostatic disease, those who have received spinal anesthesia, and those who have undergone anorectal surgery. Fever associated with UTI tends to emerge 3 to 5 days after surgery.[42] In addition to fever, patients can experience abdominal pain and sometimes ileus. Management typically includes evaluation of the urine (analysis and culture) and appropriate antibiotics when necessary. When presenting signs and symptoms are particularly severe, a diagnosis of pyelonephritis or intra-abdominal infectious complication should be considered.[30] Common infectious causes include *Escherichia coli*, *Klebsiella*, *Enterobacter*, *Pseudomonas*, and *Serratia*. When choosing the antibiotic to be administered for presumed postoperative UTI, these organisms determine the desired spectrum of coverage.[8]

Pneumonia

Almost all surgical patients are at increased risk for postoperative pneumonia. Pain limits their mobility, inspiratory effort, and ability to cough.[43] Exposure to mechanical ventilation, even for a short duration, increases the risk of pneumonia.[44] The depressed mental status induced by general anesthesia makes patients susceptible to aspiration if they vomit. Management of postprocedural pneumonia includes evaluation for leukocytosis, radiographic imaging, sputum culture, and, if appropriate, broad-spectrum antibiotics. The clinician should be mindful that, following laparotomy, radiography might reveal basilar atelectasis or pleural effusion below the diaphragm; in such cases, antibiotics are not required.[30] The decision to administer antibiotics should be based on culture and sensitivity information.[45]

Catheter-Related Bloodstream Infections

In the United States, patients in intensive care units log 15 million central vascular catheter days every year.[46,47] The use of peripheral, mid, and central catheters puts patients at increased risk for bloodstream infections and insertion-site–specific infections such as thrombophlebitis. Catheters become contaminated by 4 mechanisms (in decreasing order of frequency): (1) migration of organisms from the skin at the insertion site into the cutaneous catheter tract and along the surface of the catheter, with colonization of the catheter tip; (2) direct contamination of the catheter or its hub by contact with hands or contaminated fluids or devices; (3) hematogenous spread from anther focus of infection; and (4) contamination of infusate.[46] Patients with an indwelling catheter are at the highest risk for this type of infection.[46] During the assessment of a febrile patient with an indwelling catheter, the goal should be source control and identification of the offending organism through blood cultures. The clinician should have a low threshold for removing presumptively infected indwelling catheters early in the course of treatment, especially when disseminated infection is suspected. This removal is typically sufficient for source control. If the patient's temperature elevation and leukocytosis do not resolve within 24 hours after removal, antibiotics should be considered.[30] Coagulase-negative staphylococci are the most commonly implicated pathogens. Therefore, empiric therapy should include vancomycin (or other antibiotics that treat methicillin-resistant staphylococci).[30]

Infected Prosthetics

Procedures that involve placement of prosthetic material such as orthopedic hardware, neurosurgical ventriculoperitoneal shunts, abdominal mesh, or vascular grafting can all result in complicated surgical infections. The emergency medicine provider must recognize the prosthetic as a potential source of infection. A thorough history and physical examination, with particular attention to past procedures, should always

be performed, as infections associated with prosthetics can be indolent and may not emerge for weeks to years after the procedure.[48] Graft infections can be caused by direct inoculation of the surgical site or hematogenous spread.[49] CT, magnetic resonance imaging, or white blood cell scintigraphy can be useful, but negative findings do not necessarily rule out infection.[50]

Infection from sternal wires or a surgical-site infection on the sternum can result in devastating complications such as mediastinitis. Sternal wound infections most often occur in the acute phase of fever (within a week after the procedure).[51] Meningitis can occur after neurosurgical procedures or after placement of an intracranial drain or monitor.[30] Prosthetics are frequent causes of infection; therefore, fever after neurosurgery should always mandate aggressive diagnostic and therapeutic measures.[52]

Clostridium difficile Infections

Enteric infections caused by *Clostridium difficile* are increasing in prevalence and resistance. Infection commonly occurs after the administration of an antibiotic that alters the normally protective bacterial flora of the colon. Transmission occurs via the fecal-oral route, primarily via contaminated environmental surfaces and the hands of health care workers. Twenty percent to 50% of hospitalized patients are colonized with the organism.[30,53] Risk factors for fulminant toxic megacolon or clinically significant infection include disruption of the normal colonic flora, exposure to an antibiotic, chemotherapy, and inflammatory bowel disease.[30] Toxic megacolon is a surgical emergency requiring emergent subtotal colectomy.

When *C difficile* infection is suspected, antibiotics and fluid resuscitation should be initiated immediately. Clinicians who have initiated antibiotic therapy to prevent surgical-site and catheter-related bloodstream infections might eventually witness the sequelae of the inappropriate use of antibiotics.[5] A patient with an acute abdomen who has received antibiotics within the past 2 months should be considered at high risk for *C difficile* colitis.[30] After a sample is obtained for detecting cytotoxin, empiric treatment with vancomycin (oral or per rectum as an enema) or intravenous or oral metronidazole should be initiated. Fecal transplantation and a new macrolide antibiotic, fidaxomicin (Dificid), are newer treatment modalities directed against more resistant strains.[54]

MANAGEMENT OF POSTPROCEDURE FEVER

Management strategies for patients with postprocedure fever should take into consideration the degree of fever and the timing of its onset. Routine laboratory studies, urinalysis and urine culture, blood cultures, wound cultures, and radiographic imaging should all be tailored to individual cases. Life-threatening or potentially life-threatening causes of the fever should be given diagnostic and treatment priority. Early consultation with the operative/procedure team can clarify the diagnostic approach and target management. A postprocedure fever algorithm can help emergency care providers through key decision making.

The definitive treatment of an identified focus of fever is source control; for example, drainage of an abscess, wide debridement of necrotizing infections, or removal of a foreign body such as an indwelling catheter. Timely use of broad-spectrum antibiotics can help prevent the patient from progressing on the continuum of fever to multisystem organ dysfunction. After culture results have been obtained, the antibiotic regimen should be reviewed to stem the development of resistant organisms.

Table 5
Causes of Postoperative Fever

Non-Infectious	Infectious
Adrenal Insufficiency	Abscess
Alcohol Withdrawal	Bloodstream Infections
Atelectasis	Cholecystitis
Blood [Hematoma/CSF]	Clostridium difficile colitis
Dehydration	Endocarditis
Drug Fever	Infusion-related infections
Factitious	Intravascular device infections
Malignant Hyperthermia	Parotitis
Myocardial Infarction	Pneumonia
Neoplasms	Prostatitis
Pancreatitis	Sinusitis
Pheochromocytoma	Surgical Site Infections
Pericarditis/Dressler's syndrome	Transfusion related
Pulmonary Embolism	Urinary Tract infections
Thrombophlebitis	
Thyrotoxicosis	
Tissue Trauma	
Elsevier15Transfusion reaction	

Data from Steinberg JP, Zimmer S. Fever and Infection in the postoperative setting. In: Lubion MF, Smith RB, Dobson TF, et al, editors. Medical Management of the Surgical Patient: A textbook of Perioperative Medicine. 4th edition. Cambridge: Cambridge University Press; 2006.

SUMMARY

The diagnosis and management of postprocedure fever can be challenging. For emergency medicine providers, it is imperative that the evaluation take into consideration both noninfectious and infectious causes (**Table 5**). A clear understanding of the timing of the onset of fever in relation to the procedure (immediate, acute, subacute, or delayed) can differentiate likely diagnoses. A thorough history and physical examination are mandatory and will guide further diagnostic workup. Blood cultures, urinalysis, urine cultures, as well as routine laboratory studies can also aid in diagnosis. Imaging studies should be used judiciously, based on consideration of the procedure that has been performed. Source control remains the ultimate goal in patients found to have septic foci such as an abscess. Antibiotics should be administered promptly as an adjunct to source control.

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