

Postoperative Fevers

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KEYWORDS

- Postoperative fevers • Postoperative patients • Surgical complications
- Noninfectious fever

HOSPITAL MEDICINE CLINICS CHECKLIST

1. The incidence of postoperative (postop) fever varies widely (14%–91%) due to variation in the definition and the types of patients studied. It is, however, a common occurrence.^{1,2}
2. Although there is no definitive definition, there is general agreement that a temperature $>38^{\circ}\text{C}$ (100.4°F) in immune-compromised patients or a temperature $>38.5^{\circ}\text{C}$ (101.3°F) in immune-competent patients is considered a fever.^{1–3}
3. In general, when assessing patients for fever, axillary measurements are unreliable and should not be used. Core temperature measurements are preferred (oral, rectal, and esophageal).
4. Most cases of postop fevers are self-limiting and do not require any intervention.
5. It is important to recognize emergent and catastrophic causes of postop fever so that they can be treated early.
6. Postop fever may be infectious or noninfectious. The differential diagnosis of postop fever varies depending on the timing of the fever in relation to surgery.^{1,2}
7. Evaluation of postop patients with fever should be focused to avoid unnecessary investigations and treatments.
8. After 48 hours postop, the likelihood of an infection being the source of the fever increases.^{1–3}
9. The magnitude of the postop fever has no relationship to the presence or absence of an infection.^{1,2,4,5}
10. Atelectasis does not cause postop fever.^{6–8}
11. There are surgery-specific causes of fever to consider.^{1,9}

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12. The treatment of postop fever focuses on the underlying cause of the fever.
13. In immune-competent patients, avoid the use of empiric antibiotics.
14. Antipyretics may be administered for the symptomatic treatment of postop fever.

DEFINITIONS*What is postoperative fever?*

Postopfever is defined as an elevation of a patient's normal temperature, greater than 38°C or 100.4°F that occurs after a surgical procedure.³ The magnitude of the postop fever has no relation to the possible causes. A high fever postop is not necessarily indicative of an infectious process nor does a minimal fever rule out infection.

EPIDEMIOLOGY*How common is postoperative fever?*

Fever is one of the most common diagnostic problems during the postop period. In the first 24 hours after surgery, 27% to 58% of patients develop fever.¹⁰ In general, the incidence of postop fever is reported from 12% to 91%.^{1,3} This wide variation is due in part to the variability in definition of postop fever and the population investigated.

Which patients are more likely to have postoperative fevers?²

Postop fever is more likely to occur in patients

1. Undergoing major surgery: intrathoracic, intraabdominal, and vascular
2. After trauma, especially if the surgical field is contaminated or the trauma was extensive
3. With indwelling catheters or prolonged ventilation that increase risk of infection
4. With multiple medical problems. The risk of fever increases if comorbidities are not managed.

What factors may reduce the risk of postoperative fevers?

Procedural technique may reduce the risk of postoperative fever. For example, coronary artery bypass grafting performed without the use of the cardiopulmonary bypass pump reduces risk of postoperative fever.² Also, drugs that suppress cytokine release, such as nonsteroidal anti-inflammatory drugs, steroids, and acetaminophen, can reduce the risk of postop fevers.²

PATHOPHYSIOLOGY*What is the underlying mechanism of postoperative fever?*

Temperature is closely regulated by the hypothalamus. In general, fever occurs when the hypothalamus releases prostaglandin E₂ in response to various stimuli (pyrogens),

raising the thermoregulatory set point. This results in increased body temperature through generating heat and/or retaining heat. Postop fever may be incited by a variety of factors. Pyrogens may be endogenous (interleukin [IL]-6, interferon γ , IL-1 α and IL-1 β , tumor necrosis factor α , and macrophage inflammatory protein 1) or exogenous and are triggered by infectious or noninfectious causes.⁹ The usefulness of fever is unclear. There are several theories implying that fever aids host defense by increasing immunologic processes and hindering pathogens.¹¹ Other research points to fever having an important function in the healing process by increasing mobility of white cells and enhancing the phagocytosis in leukocytes.⁵

ETIOLOGY

What is the differential diagnosis for postop fever?^{1,2,9}

The differential diagnosis of postop fever may be considered in different ways (**Table 1**):

1. The timing of onset of the fever
2. Infectious versus noninfectious causes
3. The surgical W mnemonic: Wind, Water, Walk, Wound, Weird drugs (**Table 2**)

Although there is no validated approach, a combination of these approaches may be the most helpful. In general, approximately 20% of postop fevers are directly related to infection and 80% are related to noninfectious causes.⁴

How does the timing of postoperative fever help in the differential diagnosis?

The causes of postop fever vary in relation to the postop day of onset (see **Table 1**). The time frame for fever occurrence is the most critical factor to consider when making a differential for postop fever.¹² The timing of the fever may be categorized as follows.

Immediate Onset in the Operating Room to 48 Hours Postoperatively

The following causes often present in the first 48 hours; however, be aware that many of these causes can result in fever after 48 hours. Fever that occurs immediately postop is usually not caused by infection, except if a patient has an underlying infection before surgery.

Surgery

Eighty percent of patients with fever on the first day after surgery have spontaneous resolution of their fever in the next 24 hours.¹ The underlying causes is the surgery itself. During surgery tissue trauma leads to the release of pyrogenic cytokines, primarily IL-1, resulting in a fever that spontaneously resolves and require no further work-up. The greater the surgical trauma, the greater the febrile response.⁹ A patient's genetics may also influence how much cytokine is released in response to surgical trauma.^{2,9} This fever is usually self-limiting resolving in approximately 2 to 3 days,¹ with the rare exception of severe head trauma, in which case, for unclear reasons, the fever resolves more slowly.²

Pre-existing medical conditions

Surgical stress may lead to the exacerbation of certain medical conditions, for example, thyroid storm or a gouty flare.¹

Table 1
Causes of postoperative fever—infectious versus noninfectious related to time of onset of postop fever

Categories	Timing of Postop Fever			
	Immediate 0–48 h	Acute 48 h–7 d	Subacute 7–28 d	Delayed >28 d
Infectious	Toxic shock syndrome Pre-existing infections	UTI Pneumonia–VAP/aspiration Superficial wound infection Transfusion related Intravascular catheter related infections Acalculouscholecystitis Surgery specific—otitis media, meningitis	UTI Pneumonia Superficial wound infection Sialadenitis Foreign body infections Abscesses Surgery specific—osteomyelitis, sinusitis, peritonitis <i>C difficile</i> Deep wound infection	Foreign body infection Viral hepatitis HIV Osteomyelitis Infective endocarditis
Noninfectious				
Pre-existing conditions	Gout Hyperthyroidism Pheochromocytoma	Gout pseudogout Pancreatitis Hyperthyroidism Adrenal insufficiency		
Inflammatory	Suture Reaction	Suture reaction Pancreatitis Aseptic meningitis		
Surgical trauma	Hematoma Seroma Subarachnoid hematoma			
Vascular	MI Stroke Fat embolism Tissue infarction	MI DVT/PE Fat embolism Cavernous sinus thrombosis	DVT/PE Cavernous sinus thrombosis	
Immune	Response to surgery Transfusion reaction			
Toxic	Drug fever Alcohol withdrawal Malignant hyperthermia	Drug fever Alcohol withdrawal		

Table 2	
Mnemonic—7Ws	
W	Etiology
Wind	Pneumonia Acute chest syndrome
Water	UTI Intravascular line infections
Walk	DVT ± PE
Wound	Surgical site infections—cellulitis/deep wound infections
Weird drugs	Drug fevers—antibiotics, antiepileptics are common
Womb	Endometritis Septic pelvic thrombophlebitis, hematomas, and ovarian vein thrombosis
What?!	Thyroid storm Adrenal insufficiency Gout flare Malignancy Endocarditis Sinusitis related to nasogastric tube Catheter-related infection Drugs—immunoglobulins PE

Data from Sikora C. Fever in the postoperative patient: a chilling problem. *Canadian Journal of CME* 2004.

Adverse medication reactions

Medications are believed the most common noninfectious cause of fever although there are no reliable data to this effect.¹³ Drugs given in the preoperative, intraoperative, and postop period all may cause fever, as do implanted materials coated with antibiotics. Heparin and antimicrobials are the 2 drugs most commonly associated with postop fever.² Medications cause fever by various mechanisms:

1. Direct pharmacologic actions of the drug—can be the cause of fever¹³
2. Hypersensitivity reactions: hypersensitivity fevers are immunologically mediated and are probably the most common cause of drug fevers in the postop period.¹³ Classically, there is prior exposure to the offending agent. The subsequent reaction usually occurs after a brief re-exposure and it occurs immediately once the drug is readministered. The fever lasts as long as the drug is being given to the patient.¹³
3. Alteration in thermoregulation: fever can be caused by changes in the metabolic rate, decreased sweating, or an increase in heat generation. For example, exogenous thyroid hormone even at therapeutic doses is capable of increasing metabolic rate. Drugs that cause decreased sweating and do not allow the body to properly cool include anticholinergic agents, antihistamines, tricyclic antidepressants, phenothiazines, and butyrophenone. Sympathomimetic agents, such as epinephrine, amphetamines, and cocaine, raise catecholamines, resulting in heat generation by the body.¹³
4. Drug administration-related fever: a local inflammatory response or phlebitis after an intravenous infusion or an even more serious reaction, such as the development of a sterile abscess, can result in fever. Inflammatory phlebitis can occur from infiltration or irritation by hypertonic fluids or other medications. The intravenous catheter itself can cause mechanical irritation resulting in fever.

5. Idiosyncratic drug fevers¹³:

Idiosyncratic causes of drug fever cannot be explained by any of these mechanisms discussed previously. Some classic examples include the neuroleptic malignant syndrome and malignant hyperthermia from inhaled anesthetics.

Complications of surgery

Complications from surgery, such as hematomas and seromas, usually present early and should be considered during the work-up of early postop fever. Patients may have a foreign body or an acute inflammatory response to sutures or any surgical prosthesis used during the course of surgery.¹

Blood transfusion reactions

Most blood transfusion reactions occur during the administration of blood products or immediately after (up to an hour) and this reaction is immune mediated. Delayed serologic and delayed hemolytic transfusion reactions are more commonly seen in patients who were previously sensitized with prior transfusions or pregnancies.¹

Cardiovascular causes

Postop myocardial infarction, infarction of the operated tissue, fat embolism, and postop stroke may present with fever during the immediate postop period.¹

Withdrawal from alcohol

Alcohol withdrawal as a cause of fever should be considered in all patients because it can be the presenting symptom after acute cessation of alcohol or accompany delirium tremens, which may occur 48 hours after alcohol cessation.^{1,2}

Acute—Fever 48 Hours to 7 Days

Infectious causes of postop fever become more likely when postop fever is discovered after 48 hours.^{1,2} Occasionally, the infectious cause may have existed before surgery, but commonly, the infectious cause is as a result of procedures, maneuvers, or complications immediately postop. Infections frequently identified include the following.

Urinary tract infections

The risk of having a urinary tract infection (UTI) is directly related to the duration of catheterization and is more common in patients who have undergone genitourinary surgery.^{1,2,12}

Pneumonia

Patients who receive mechanical ventilation intraop are at risk for ventilator-associated pneumonia (VAP). The longer the duration of mechanical ventilation, the higher the risk of developing VAP.² Also, aspiration pneumonia should be considered in patients who have a nasogastric tube (increases gastroesophageal reflux disease and risk for aspiration), vomit immediately after surgery, or have a depressed mental status or gag reflex.^{1,2}

Superficial thrombophlebitis

Superficial thrombophlebitis occurs in patients with intravenous catheters, resulting in exit site infections and bacteremia, especially if they were placed emergently under nonsterile conditions.² Careful evaluation of all catheter sites is important in the work-up of fever.

Surgical site infections

Wound infection in the first few days is rare, usually presenting more after 7 days.¹ The wound infections that may present during the 7-day period after surgery are usually superficial -wound cellulitis. There are, however, 2 organisms that can cause fulminant surgical-site infections and should always be considered.^{1,2}

1. Group A streptococcal and
2. Clostridial infections

Additionally there are certain infections that can present in the acute postop period that are associated with specific surgeries (specific surgical infections discussed later).

Rare causes include

Acalculous cholecystitis due to hematogenous spread of bacteria² and acute infections caused by blood transfusion and blood products can occur.¹

Noninfectious conditions to be considered during the 48-hour to 7-day time frame include:

1. Drug-induced fever (discussed previously). Drug-induced fever is a diagnosis of exclusion and should be considered in patients with postop fever at any time.^{1,2,12}
2. Gout and pseudogout.^{1,2}
3. Alcohol withdrawal—Delirium tremens in patients with a history of alcohol use disorder usually presents during this time period.^{1,2}
4. Pancreatitis—can occur with almost any surgery and is not limited to abdominal surgeries. Abdominal surgery, adverse reactions to medication, and preop alcoholism all increase the risk of postop pancreatitis. The pathophysiology is poorly understood and its prevalence is unknown.¹
5. Vascular: myocardial infarction and thromboembolism.¹

Subacute Fever—7 Days to 28 Days

During the subacute time period it is important to look for infections.² Pneumonia, UTI, and catheter-related intravascular infections should be considered. Others to consider include

1. *Clostridium difficile* diarrheal infection related to antibiotic^{1,2,12}
2. Deep wound infections and abscesses^{1,2,9}
3. Foreign body infections due to orthopedic hardware, prosthetic valves, stents or grafts, and endovascular devices^{1,2,9,12}
4. Osteomyelitis, in particular in patients after orthopedic surgery
5. Sinusitis from prolonged nasogastric tube insertion^{1,9}

Noninfections conditions to consider as a cause for fever during the subacute period include

1. Deep vein thrombosis and/or pulmonary embolus from prolonged immobility^{1,9}
2. Myocardial infarction or stroke¹
3. Cavernous sinus thrombosis^{2,9}
4. Sialadenitis—inflammation of the salivary glands, in particular, in elderly, debilitated, or malnourished patients with poor dentition^{1,2,9}

Delayed Fever in the Postoperative Period After 28 Days

During this time frame, fever postop should prompt a thorough assessment for infection.^{1,2}

1. Osteomyelitis after orthopedic surgery¹
2. Viral infections related to blood products—CMV, hepatitis, HIV^{1,2}
3. Parasitic infections—toxoplasmosis¹
4. Rarely, surgical site infections can occur in this period caused by indolent organisms, such as coagulase negative staphylococci.^{1,2,9}
5. Infective endocarditis usually due to periop bacteremia^{1,2}

The 7 Ws is a simple mnemonic memory tool that can help in the rapid recall of a differential at the bedside. These can then be modified based on the individual patient and surgical procedure (see **Table 2**).³

SPECIFIC SURGICAL CONSIDERATIONS

Does the type of surgery matter in postoperative fevers?

Orthopedic Surgery

Early postop fever in this setting is usually self-limited but if fever persists consider including venous thromboembolism, hematoma, and/or wound infection.^{2,3}

Abdominal Surgery

Deep abdominal abscesses need to be considered because they may require imaging studies and needle aspiration to differentiate hematomas versus abscesses. Empiric antibiotics to cover gram-negative bacteria and anaerobes should be instituted and if there is no resolution of fever. Pancreatitis, especially after upper abdominal surgery and cholecystitis, should also be considered.^{2,3}

Urologic Surgery

UTI at any level can lead to postop fever. Deep infections, such as prostatitis and perinephric abscesses, may result in fever, pain, and a bland urinalysis, so they need to be considered. Infections can spread from the lower to upper urinary tract so lower urinary tract manipulation does not preclude upper tract involvement.^{1,2}

Obstetric and Gynecologic Surgery

Endometritis is an important consideration, especially postdelivery, in patients with pre-existing medical problems, premature rupture of membranes, difficult deliveries, and internal fetal monitoring. Patients may present with fever, pelvic pain and purulent vaginal discharge. Postgynecologic surgery, postop fever may be as a result of UTI, cellulites, abscesses (deep or superficial), necrotizing fasciitis, or pelvic thrombophlebitis.^{1,2,4,9}

Neurosurgery

It is important to rule out chemical versus infectious meningitis as a cause of postop fever in this setting. In both cases, the patient may have headache, photophobia, and nuchal rigidity, so a cerebrospinal fluid examination is helpful. Chemical meningitis can be considered if no seizures are observed, patient is not delirious, surgical site shows no evidence of inflammation, fever is less than 102.9°C, and cerebrospinal fluid white blood cell count (WBC) is less than 7500 and glucose greater than 10 mg/dL.² Antibiotics can be held in this case with frequent reexamination.² Venous thromboembolism is more frequent in this group of patients given limited mobility and a contraindication for prophylactic anticoagulation.^{2,3}

Cardiothoracic Surgery

Fever is common in the first few days after cardiothoracic surgery, so investigations are not recommended until 3 days postop unless there are other indicators of physiologic instability.^{2,3} Pneumonia is common in these patients (5%),³ especially if they require re-intubation, demonstrate neurologic dysfunction, develop hypotension, or require transfusion greater than 3 units of blood. Pleural effusions rarely require evaluation in this setting because they are common in these postop patients. Sternal wound infection is seen in 1% to 5%.² Those patients at higher risk of sternal wound infection include patients undergoing emergent or longer and more complicated surgical procedures, patients who are obese, smokers, or who have diabetes mellitus or who have end stage renal disease and are on hemodialysis.^{2,9}

Vascular Surgery

Graft infections due to either direct inoculation of the surgical site or hematogenous spread are a common cause of postop fever. Unfortunately they are difficult to diagnose. Patients may have pain and nonhealing at the operative site. Imaging studies can be helpful in diagnosis but negative imaging does not preclude graft infection. Postimplantation syndrome results in fever, elevated WBC and perigraft air and requires no antibiotics because fevers resolve within 24 to 48 hours.^{1-4,10}

Otolaryngology

A rare vascular complication that may occur in head and neck surgical patients is cavernous sinus thrombosis. This should be suspected if patients demonstrate cranial nerve abnormalities.¹

EMERGENT CAUSES OF POSTOPERATIVE FEVER

What causes of postop fever should not be missed?

There are several “don’t-miss causes” to be aware of. Early identification and treatment are critical to good outcomes (**Table 3**).^{1,2}

HISTORY AND PHYSICAL

What should be considered when taking a history for postoperative fever?

The history should focus on eliciting any factors placing patients at risk for postop fever, including the following:

Questions to ask about fever^{1,2}:

1. When did the fever start in relation to the surgery?
2. What is the maximum temperature and when does it usually occur?
3. How the fever was measured and the maximum temperature?

Question to ask about patient risk factors^{1,2}:

1. Is the patient immunosuppressed or malnourished? Both have a higher predisposition to infection.
2. Comorbidities, including underlying malignancy, hyperthyroidism, illicit drug use, gout, adrenal insufficiency, alcohol use, and diabetes.
3. Was there trauma and, if so, what was the degree of trauma?
4. Indwelling tubes, lines, or catheters?

Condition	Key Points
Malignant Hyperthermia	Adverse reaction to inhalation anesthesia—halothane or succinylcholine Signs and symptoms: tachycardia, metabolic acidosis, elevated temperature, and muscle rigidity
DVT/PE	Check if patient has been on DVT prophylaxis Signs and symptoms: high index of suspicion for -fever, tachycardia, difficulty breathing, or hypoxia
Toxic shock syndrome	A rare bacterial wound infection from <i>Staph aureus</i> or group B hemolytic strep ^{1,2,12} Signs and symptoms: fever, hypotension, skin rash, shock
Alcohol withdrawal and delirium tremens	Consider in anyone with alcohol use disorder Signs and symptoms: tremor, tachycardia, sweats, hallucinations, fever, nausea, anxiety
Immunosuppressed patients	Any fever requires urgent investigation Consider fungal infections Start empiric broad-spectrum antibiotics as soon as possible after detecting fever
Pseudomembranous colitis	Consider in any patient who develops diarrhea or fever

Questions to ask about surgery^{1,2,9}:

1. Was the surgery emergent or elective?
2. What procedure was done?
3. What were the surgical findings?
4. Where there any intraoperative complications?
5. Was the surgery prolonged?
6. What medications or blood products were administered during the perioperative period?

Questions to ask about medication or blood product use:

Both a patient's chronic medications and medications used in the perioperative period should be noted. Particularly important are if specific antibiotics, including cephalosporins, β -lactams, sulfonamides, vancomycin, or fluoroquinolones, were used because these antibiotics are more associated with drug fevers (**Table 4**). Administration of blood or blood products perioperatively may cause a transfusion reaction resulting in fever.¹

Antibiotics—cephalosporins	
β -Lactam	
Sulfonamides	
Vancomycin	
Fluoroquinolones	
Hydroxyurea	Heparin
Propylthiouracil	Thiazide diuretics
Iodides	Salicylates
Allopurinol	Phenytoin
Immunoglobulins	Hydralazine

Questions to ask about associated symptoms^{1,2,9}:

Symptoms can help identify possible causes of fever. **Table 5** lists symptoms that may be elicited and possible differentials.

Are there specific parts of the physical examination to consider?

A focused physical examination based on findings from the history and possible differentials should be performed.^{2,3,9}

Vital Signs

Note immediate vital signs as well as the perioperative vital signs, paying special attention to the extent and pattern of the fever so as to be able to correlate it with symptoms and signs elicited.

General

Note the general appearance of the patient. Often patients do not appear ill when the cause of fever is noninfectious.^{2,9}

Neurologic

Note mental status and perform a full neurologic examination if considering a subarachnoid hematoma, stroke, delirium, or medication effect. Neck stiffness (meningitis) may also be elicited.^{1,3} Cranial nerve abnormalities involving the eyes may indicate cavernous sinus thrombosis after neurosurgical procedures.

Table 5 Symptoms that can be associated with causes of fever in the postoperative setting	
Symptoms	Consider
Shortness of breath, pleuritic chest pain with lower-extremity swelling	Deep vein thrombosis/pulmonary embolism
Cough, shortness of breath, chest pain	Pneumonia
Cloudy urine, dysuria, hematuria	UTI
Sweating, palpitations, heat intolerance, headaches	Hyperthyroidism/phaeochromocytoma
Abdominal pain, bloating, nausea, vomiting, change in bowel habit	Intra-abdominal abscess/pancreatitis
Diarrhea, abdominal pain and/or distension	<i>C difficile</i>
Chills, rigors	Sepsis
Pain, swelling, and redness at the site of intravascular catheters or implants	Foreign body infection/catheter-associated infections
Pain at the wound site	Wound site infection
Rhinorrhea and sinus pain	Sinusitis
Headache, neck pain/stiffness, visual disturbances, focal neurologic deficits (after neurosurgery)	Meningitis/stroke
Ear pain, otorrhea (after ear, nose, and throat surgery)	Otitis media
Tremor, hallucinations, confusion, nausea	Alcohol withdrawal
Joint pain and swelling	Gout/pseudogout exacerbation

Data from Refs. 1,2,4,9,10

Head; Eyes; and Ear, Nose, and Throat

Observe for drainage from the nares or the ears that may indicate sinusitis (look also for facial swelling and tenderness) or otitis, respectively. Check the mouth for involvement of the salivary glands—pus being extruded from salivary gland openings (bacterial sialadenitis).^{1,4,9}

Cardiovascular

Tachycardia is nonspecific but a new murmur may indicate pulmonary embolism, myocardial infarction, or infectious endocarditis.^{3,9}

Pulmonary

Respiratory examination that includes respiratory distress, poor air entry, unilateral crackles, and bronchial breath sounds with or without adventitious breath sounds (wheezing, aegophany, and so forth) may indicate a pneumonia.^{1–3} Atelectasis may be present and detected as fine crackles on physical examination but atelectasis does not cause fever, despite the widespread misconception.^{1,2,6,14,15}

The surgical site should always be examined for signs of infection, such as inflammation, tenderness, or purulent discharge. Check for fluctuance because this may represent a hematoma or a seroma at the operative site. Seromas are notoriously painless, so patients may have no discomfort.¹

Abdominal examination for bloating, change in bowel sounds, and tenderness with or without peritoneal signs may indicate an abscess, pancreatitis, ischemia on operated tissue, or acute cholecystitis.^{1,2,9}

All catheter sites should be examined, looking for evidence of thrombophlebitis or cellulitis.^{1,2,12} Observe the urine—cloudy urine may be indicative of an infection.

Musculoskeletal Examination

Examine limbs for signs of DVT and joints for swelling, erythema, and tenderness, indicating acute arthritis-gout or pseudogout.^{1–3,9} Examine the skin thoroughly for rashes, urticaria, or swelling or ulcers.^{1,2}

DIAGNOSTIC WORK-UP OF POSTOPERATIVE FEVER

What laboratory and imaging tests should be done?

There are no specific tests indicated for the evaluation of patient with postop fever. A patient's history and physical examination and timing of the fever and host immune status help to determine which laboratory tests should be done. Postop fever work-ups, within the first 48 hours after surgery, do not usually provide a high clinical yield.^{1–3}

Diagnostic work-up once a differential is obtained may include the following.^{2,9}

Microbiology

If the initial history, physical examination, and initial laboratory work-up suggest that an infectious process, it is appropriate to obtain blood, urine and/or sputum cultures, wound swabs and culture, aspiration of fluid collections, and culture of intravascular catheter tips on removal. Lumbar puncture should be considered in postop neurosurgical patients who in have meningeal signs and fever.^{1–3,16}

Imaging

Basic chest radiograph is appropriate to start with because it may reveal cavitation, consolidations, infiltrates, effusions, and other findings to concur with the initial

assessment. Ultrasound may locate fluid collections, such as hematomas (hypoechoic) or seromas (anechoic) and gall bladder disease as well as deep vein thrombosis in the extremities.¹⁻³ CT scan used may be used to detect abscesses in the abdomen and or pelvis, pulmonary emboli in the chest. It also may be used to help in the work-up of sinusitis or sialadenitis.^{1,3}

Specific considerations before ordering tests:

1. A fever in the first 48 hours is unlikely to represent an infectious cause and further diagnostic testing is of low yield. If history and physical examination suggest infection or other underlying cause or if a patient is immunocompromised, however, then a more detailed work-up is warranted.^{1,2}
2. Immunocompromised patients should have a thorough investigation for infection, including complete blood count, chest radiograph, urinalysis, and urine and blood cultures, because the likelihood of unusual pathogens causing infection and fever are much higher.²
3. In patients who have received blood, a blood transfusion reaction should be worked up.¹
4. After 48 hours, infection as a cause of postop fever becomes more likely, so it is recommended that a complete blood count, chest radiograph, urinalysis with urine and blood cultures be done in all patients presenting with postop fever at this time, to rule out an infectious process or identify a source quickly.^{1,2} In general, an elevated WBC with a left shift, although nonspecific, may suggest an infection.^{2,3} Wound cultures from the surgical site when there is purulent drainage may be helpful and sputum cultures if a patient has a productive cough.^{1,2}
5. Consider joint aspiration if patients have symptoms or signs suggestive of gout or pseudogout.

MANAGEMENT

How does management of fever differ in postop patients?

Management of postop fever depends on the probable cause. In general, early postop fever requires no intervention if there are no mitigating factors, such as immunocompromised state, transfusion reaction, clear infectious site, or catastrophic early event.^{1,2,9} These factors are usually picked up in the history and physical examination. The fever itself should be treated if it may improve patient comfort. To minimize the physiologic stress and metabolic demands of fever and shivering, acetaminophen is recommended unless there is a contraindication to its use. Consider stopping all unnecessary treatments and medications and removing catheters. Further management depends on the cause of the fever.^{1-3,9}

When should antibiotics be given?

Empiric antibiotics should not be used routinely unless

1. There is a clear source of infection
2. The patient is immunocompromised
3. There is systemic inflammatory response syndrome with organ dysfunction
4. There is hemodynamic instability
5. A patient is in an ICU after major surgery

Empiric antibiotics should be broad spectrum and tailored to cover the possible organisms, then narrowed based on culture findings. Consider nosocomial

infections—especially in patients who are in an ICU or are ventilated. If, after 48 hours of work-up, no source of the fever is found and cultures do not yield an organism, consider stopping antibiotics.^{1–3,12}

SUMMARY

Postop fever is a common postop surgical complication. Approach to this presentation should be based on the time frame in which the fever presents and tailored to individual patients. Fever in this setting may be infectious or noninfectious. The most common cause of noninfectious fever is a medication reaction. Early postop fever usually requires no extensive work-up or management except in specific circumstances. Antipyretics are indicated in patients with temperature greater than 39°C. Antibiotics should be judiciously used depending on the possible infectious source and factors, such as the immune state. Patient outcomes are better if there is rapid identification of the cause of the fever with appropriate resuscitation and antibiotic treatment where necessary.

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