

## Causes and Management of Postoperative Fever

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### ABSTRACT

Postoperative fever presents a frequent and at times, thorny issue for the clinician. Whereas fever is frequently a normal phenomenon in the prompt post-surgical period, massive amounts of resources are used each day in the quest of more unfavorable diagnoses. The occurrence of a postoperative fever is not always suggestive of an infectious process. Mild temperature rise might be transient in nature and can emerge from the body's reaction to tissue damage. Fevers that present from two to more than seven days after a surgical procedure can be caused by other physiological reactions. Perioperative nurses can target nursing assessments according to the postoperative day on which the fever presents.

**Keywords:** Fever, Postoperative, Body Temperature, Management, Fever Timing.

### INTRODUCTION

Fever is common amid postoperative patients; so that postoperative fever is a known term in the literature even though the fact that the syndrome has not been well characterized. Furthermore, postoperative fever is broadly believed to be benign and frequently ascribed to non-infectious causes<sup>[1, 2]</sup>. It is assessed that 27-45% of patients in intensive care units (ICUs) are febrile at some point<sup>[3,4]</sup>. Several examinations show that the cause of fever in the ICU is similarly likely to be infectious or non-infectious<sup>[5, 6]</sup>. Among surgical patients, fever is more likely because of infection as the time interval following surgery increases. Normal body temperature includes an extensive variety of values, but for practical purposes a fever has been defined as 38.3°C (100.4° F) and above in ICU patients and may be defined as such in surgical patients<sup>[5, 7]</sup>. In the first 48 hours of the postoperative period a fever is nearly always non-infectious in origin. The inflammatory mechanisms accountable for postoperative fever have been the subject of a number of studies. Tissue damages alone results in the disruption of phospholipids from the cell membrane, leading to a cascade of prostaglandins and cytokines which ultimately lead to a body temperature elevation<sup>[8]</sup>. Nevertheless, fever that continues beyond 96 hours normally warrants further attention.

In a prospective observational study of 93 ICU patients, nearly 70% of whom had experienced elective surgery, a temperature elevation to at least 38.4°C was present in 65 cases (70%), more than half of which were simply

defined as postoperative. Fever was allied with a significantly higher severity of illness (by APACHE II score), but not among those with "postoperative fever." Fever itself was not associated with increased mortality, although prolonged fever (>5 days, usually due to infection) was associated thusly. In contrast, early postoperative fever ensues in fewer than 15% of non-critically ill patients<sup>[10]</sup>. The causes of postoperative fever require better definition<sup>[2]</sup>. There are several potential causes, including the pro-inflammatory response to tissue injury and surgical stress, the infection that required surgical treatment among emergency surgery patients, occult community-acquired infection, and surgical site infections. Potential non-infectious causes include tissue ischemia/infarction, hematoma, venous thromboembolic disease, and controversially, atelectasis. Patients may have more than one cause of fever, and infectious and non-infectious causes may co-exist. Among patients with purely infectious causes of fever, multiple infections may co-exist<sup>[10]</sup>. The evaluation of fever can be protracted and costly<sup>[11]</sup> due to the low yield of many diagnostic tests, and eventually, in as many as 30% of cases<sup>[9]</sup>, the cause of postoperative fever may never be found.

Nevertheless, fever is one clinical indicator of the pro-inflammatory state identified as systemic inflammatory response syndrome<sup>[12]</sup>, which does not have benign significances for surgical patients, particularly when persistent or fully manifest. **Talmor et al.**<sup>[13]</sup> studied 2,300 consecutive

surgical ICU patients, result that persistent systemic inflammatory response syndrome was allied with a higher possibility and a greater degree of subsequent organ dysfunction, and an increased mortality rate. Napolitano et al. [15] established that the attendance of SIRS upon hospital admission following trauma was an independent predictor of mortality after wound. The occurrence of systemic inflammatory response syndrome on admission subsequent blunt trauma was a significant independent predictor of nosocomial infection, which in turn predicted mortality. Among the four components of systemic inflammatory response syndrome, temperature was the most powerful predictor [15]. Furthermore, if systemic inflammatory response syndrome persevered for 7 days after trauma, the possibility of death was increased nearly five-fold [16].

### MATERIALS AND METHODS

#### •Data sources and search terms

We conducted this review using a comprehensive search of MEDLINE, PubMed, EMBASE, Cochrane Database of Systematic Reviews, and Cochrane Central Register of Controlled Trials from January 1, 1985, through June 25, 2017.

#### •Data extraction

Two reviewers independently reviewed studies, abstracted data, and resolved disagreements by consensus. Studies were evaluated for quality. A review protocol was followed throughout.

#### Pathophysiology of postoperative fever

Fever is an indication of cytokine release in response to a range of stimuli [8-10]. Fever-associated cytokines, comprising interleukin (IL)-1, IL-6, tumor necrosis factor (TNF)-alpha, and interferon (IFN)-gamma, are created by a variety of tissues and cells. There is some evidence that IL-6 is the cytokine most closely correlated with postoperative fever [17]. Fever-associated cytokines are discharged by tissue damage and don't certainly signal infection. The extent of the damage is associated with the level of the fever response.

For instance, laparoscopic cholecystectomy is allied with less tissue damage and fewer episodes of postoperative fever than is open cholecystectomy. Correspondingly, there is less postoperative fever when coronary artery grafting is done without the utilization of a cardiopulmonary bypass pump [18]. Genetic factors can impact the magnitude of the cytokine release

in response to tissue damage, and therefore the magnitude of self-limited postoperative fever. For instance, youngsters with osteogenesis imperfecta experiencing orthopedic surgery appear to have a greater and more sustained febrile response than matched controls [19].

Bacterial endotoxins and exotoxins can empower cytokine discharge and cause postoperative fever. Microscopic organisms or pieces of microorganisms translocated from the colon (e.g., as an outcome of perioperative ileus or hypotension) might be in charge of a few scenes of self-constrained postoperative fever.

Lifted levels of bacterial DNA have been exhibited with polymerase chain response (PCR) testing of blood from surgical patients, even in patients whose blood societies are negative. Non-steroidal anti-inflammatory agents (NSAIDs) and glucocorticoids suppress cytokine release and thus diminish the magnitude of the febrile reaction [20].

#### Causes of postoperative fever

Postoperative fever can be a side effect of an extensive variety of determinations including an assortment of irresistible causes, for example, those starting in the urinary tract, respiratory framework, and wounds, and in addition noninfectious causes, for example, myocardial dead tissue, pneumonic embolus, and medication responses [21] (Table 1). It is essential that each case of fever is drawn closer in a deliberate way to decide the underlying driver. Postoperative fever assessments should consider various variables including timing (i.e., how soon or how long postoperatively the patient is), the patient's own particular therapeutic, surgical, and social history, and also points of interest of the system including critical occasions involving the patient's preoperative, intraoperative, and postoperative course. Also, a centered physical appraisal and any extra indications the patient is encountering ought to be considered in assessing the clinical essentialness of a postoperative fever and deciding proper activity. While an entire blood check assessing leukocyte tally (white blood cells [WBCs]) might be the primary sign of an irresistible procedure and is normally assessed in the postoperative patient day by day, it is a nonspecific marker of disease. The WBCs are typically raised within the sight of disease; be that as it may, in the malnourished or immunosuppressed patient, they might be ordinary or decreased also [22]. In this manner, while WBCs might be a useful marker following disease in some postoperative febrile patients, the whole clinical picture ought to be analyzed.

A cautious review of medications the patient is receiving is imperative as a variation of different medications, comprising certain antimicrobial agents, can generate drug fever [23]. See Table 2 for a list of potential medications that have been known to cause fever. Patients may

have a generalized maculopapular, pruritic rash that may involve the palms and soles. Relative bradycardia (i.e., a pulse lower than would be expected in the face of the temperature elevation) indicates a strong possibility of drug fever.

**Table 1:** Causes of postoperative fever

<b>Infectious</b>	<b>Noninfectious</b>
Surgical site infection	Gout
Pneumonia	Hematoma
Urinary tract infection	Thyrotoxicosis
Abscess	Bowel leak
Pancreatitis	Blood transfusion
Cholecystitis	Adrenal insufficiency
Clostridium difficile	Malignant hyperthermia
Sinusitis	Deep vein thromboses
Endocarditis	Subarachnoid hemorrhage
Prosthesis infection	ETOH/drug withdrawal
Meningitis	Medication/drug fever
Myonecrosis	Pulmonary embolus
Phlebitis/intravascular related	Myocardial infarction
Bacteremia/blood stream infection	

**Table 2:** Causes of drug fever

<b>Antimicrobials</b>	<b>Antineoplastic agents</b>
Macrolides	Doxorubicin
Isoniazid	Chlorambucil
Nafcillin	Procarbazine
Ampicillin	Cisplatin
Amoxicillin	Bleomycin
Piperacillin	Hydroxyurea
Penicillin G	Methotrexate
Vancomycin	5-Fluorouracil
Gentamycin	<b>Cardiovascular agents</b>
Streptomycin	Hydralazine
Amphotericin	Captopril
Cephalosporins	Procainamide
Trimethoprim-sulfamethazole	Quinidine
<b>Central nervous system agents</b>	Nifedipine
Phenothiazides	Catecholamines
Methyl dopa	Triamterene
Barbituates	<b>Other</b>
Cocaine	Allopurinol
Amphetamines	Folic acid
Anticholinergic agents	Aspirin
Monoamine oxidase inhibitors	Ibuprofen
Phenytoin	Iodides
<b>Anesthetic agents</b>	Cimetidine
Halothane	
Enflurane	
Succinylcholine	

## Management of postoperative fever

### • Fever timing

Timing after surgery is an essential factor to consider in assessing the etiology of a postoperative fever. Various investigations have been completed in various patient populations and include concluded that inside the initial 48 h after surgery, fever is generally a typical part of the febrile reaction (in view of cytokine discharge because of tissue control or injury) and isn't characteristic of a contamination<sup>[21]</sup>. An essential special case to note is the postoperative febrile patient who creates what is known as harmful hyperthermia, a possibly deadly autosomal overwhelming acquired disorder described most prominently by strong unbending nature and to a great degree high temperatures (around 40.6° C–41.1° C). It is a hypermetabolic express that shows with tachycardia, hypercarbia, hypoxemia, hyperkalemia, confirmation of rhabdomyolysis, and arrhythmias<sup>[24]</sup>. It can happen inside minutes or up to 2 days after starting medication organization of certain sedative specialists, most ordinarily succinylcholine and halothane<sup>[25, 26]</sup>. Thusly, the lion's share of postoperative fevers that happen amid the initial 48 h after surgery (and some exploration has even stretched out this further to postoperative day 5) are for the most part ascribed to the typical incendiary reaction and not an irresistible procedure gave the patient is generally hemodynamically steady<sup>[27]</sup>. In situations where the patient is hemodynamically precarious, regardless of the planning after surgery, other potential reasons for postoperative fever ought to be considered and suitable work ought to be led.

### • Focused physical exam

Along with gaining information about the patient's past restorative history, kind of surgery, and occasions of their hospitalization, a centered physical examination is important as it might likewise uncover the etiology of postoperative fever. A great part of the physical examination and resulting assessment will be guided by every patient's specific side effects. What's more, in view of the consequences of the physical examination and the patient's side effects, this will control the symptomatic investigations that should be done to absolutely analyze a considerable lot of the reasons for postoperative fever. The most widely recognized postoperative diseases are those including the respiratory framework, the genitourinary framework, and in addition the

injury, and in this manner, these three evaluations merit extraordinary consideration<sup>[21]</sup>.

### • Wound evaluation

A patient's wound ought to be assessed for redness, purulent drainage, temperateness, and pain or tenderness, as these all might be indications of a surgical site infection. In these cases, a wound culture ought to be sent for examination if conceivable and day by day management ought to be carried out to track for expanding or diminishing indications of wound infection. In cases of a deeper tissue infection or an infected hematoma, a radiological imaging study such as an ultrasound or a CT scan might require to be carried out to additionally assess the wound. Furthermore, the wound might need to be opened to be fully assessed and refined<sup>[22, 28]</sup>.

### • Respiratory evaluation

On the off chance that a patient is encountering respiratory symptoms postoperatively, for example, shortness of breath, cough, and sputum generation or their physical examination uncovers unusual breath sounds, tachypnea, or diminished heartbeat oximetry levels, the primary appraisal strategy is typically a chest x-beam to assess for pneumonia. A sputum culture might likewise be helpful to guarantee suitable antibiotics are chosen. Especially in patients after general anesthesia or the individuals who are on drawn out ventilation, the danger of creating pneumonia is expanded. Conflicting to common belief, it has been exhibited that there is a poor connection amid atelectasis and postoperative fever such as atelectasis does not cause fever. On the off chance that shortness of breath continues or is the essential worry in a postoperative febrile patient, a computed tomography (CT) scan to assess for pulmonary embolus might be demonstrated. Patients at expanded danger of creating aspiratory emboli incorporate the individuals who are stationary, have lower limb immobility, have a harmful neoplasm, or are taking oral contraceptives<sup>[5]</sup>. Pneumonic embolism ought to be considered in postoperative febrile patients with unexplained hemodynamic unsteadiness<sup>[21, 28]</sup>.

### • Cardiac evaluation

Myocardial infarction and endocarditis may similarly present postoperatively with fever. Should a patient experience any indications or symptoms suggestive of chest pain, an electrocardiogram and cardiac enzymes ought to directly be ordered and evaluated. A focused physical exam ought to be carried out so that the

evaluation for any changes in heart sounds or occurrence of murmurs. Patients with mechanical heart valves are at increased risk of increasing endocarditis and consequently ought to have an echocardiogram carried out to assess for vegetation or infected heart tissue <sup>[22]</sup>.

• **Neurological evaluation**

If a patient felt a symptoms of neck pain confusion, headache, or new neurological deficits are revealed on physical examination, a CT scan ought to be carried out to evaluate for a subarachnoid hemorrhage or neoplasm which might be the reason of postoperative fever. If a patient has signs or symptoms indicative of meningitis, a lumbar puncture might be essential to confirm or exclude this diagnosis <sup>[23]</sup>.

• **Abdominal evaluation**

In febrile patients who have abdominal pain, mainly in those who have had abdominal or pelvic surgery, a CT scan might be essential. These patients may have painfulness, protecting, firmness, or distention on examination. Many patients after abdominal or pelvic surgery will have some degree of tenderness that is normal and predictable after surgery. Regularly it is needed to use approaches of distraction through the examination to evaluate the true degree of tenderness. In patients with tenderness, firmness, distention, protecting, or peritoneal signs and in those who complain of nausea and vomiting, a CT scan might be essential to evaluate for abscess formation, pancreatitis, cholecystitis, myonecrosis, or bowel leak.

In the case of cholecystitis or pancreatitis, evaluation of serum amylase and lipase levels might support in the diagnosis too. In febrile patients with abdominal pain and diarrhea who have received antibiotics before or throughout their hospitalization, stool cultures ought to be sent to evaluate for *Clostridium difficile* <sup>[22]</sup>.

• **Extremity evaluation**

A postoperative fever might be characteristic of profound vein thromboses, so furthest points ought to be assessed for pain, swelling, and redness, and Homan's sign ought to be checked. An ultrasound of the influenced furthest point ought to be completed to survey for thromboses. Moreover, intravascular gadgets (both peripheral and central) ought to be evaluated at and around their inclusion destinations for redness, agony, and swelling and whether they are as yet required every day in the postoperative febrile patient as these can be a standout amongst the most incessant wellsprings of nosocomial contamination. Intravascular-related

contamination can start as shallow phlebitis and prompt hazardous bacteremia or sepsis <sup>[28]</sup>.

**CONCLUSION**

Postoperative fever is frequently a normal inflammatory response to surgery, nonetheless it may similarly manifest from a serious underlying infectious or noninfectious origin. Consequently, it is essential to approach each occurrence of postoperative fever in a systematic and orderly manner. The diagnostic algorithm displayed enables the practitioner a pictorial guide to this systematic approach. This approach takes into account multiple factors so that suitable diagnostic tests may be ordered to allow cost-effective, precise, and goal-directed action.

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