



BY JARROD SHAPIRO, DPM

# Atelectasis Does Not Cause Post-Operative Fever

Research debunks a long-held inaccuracy.

*Practice Perfect is a continuing every-issue column in which Dr. Shapiro offers his unique personal perspective on the ins and outs of running a podiatric practice.*

Perhaps the most common question students are asked is to state the five W's of post-operative fever. One can understand the purpose of this question: It requires a first order memorization while having a higher order clinical applicability to an important medical subject. Often called the "Rule of W," it has some variations but goes something like this:

## 5 Reasons for Post-Operative Fever—the Rule of W?

- Wind = atelectasis/pneumonia (24-48 hours)
- Water = urinary tract infection (3-5 days)
- Wound = wound infection (5-7 days)
- Walking = venous thromboembolism (5-10 days)
- Wonder drug = drug fever (anytime)

Many of us have been taught if the patient has a fever within the first 24 hours, the most common cause is atelectasis. You dutifully memorized this "fact" and prescribed incentive spirometry to all of your hospitalized patients, thinking you were doing something helpful. You are then disconcerted to find out that atelectasis is, in fact, not a cause of post-operative fever. You might think at first



that you may be ignorant and should have known this, but during a recent academic session with students and residents, this very question came up using a well-known board review question system indicating it's the continued presence of this inaccuracy in our knowledge base.

As a very quick review, atelectasis is the loss of lung volume due to collapse of lung tissue.<sup>1</sup> This may occur for several reasons including compression by a space-occupying lesion such as a tumor or infection, scarring of lung tissue, pleural effusion, pneumothorax, or blockage of an airway (termed obstructive atelectasis). In the operative setting, obstructive atelectasis may theoretically occur as a result of breathing gas with a high fractional inspiration of oxygen (FiO<sub>2</sub> or simply the amount of oxygen in the gas).

Yes, atelectasis does not cause post-operative fever. Let's take a look at the research to support this claim.

You will be even more perturbed to know the evidence against atelectasis has been building since the 1990s! We'll point out here that most of the research is in general and cardiac surgery patients, and no studies exist that include lower extremity surgery. However, since atelectasis is most common in cardiac and general surgery, it is fair to extrapolate the findings to podiatric surgery.


Engoren<sup>2</sup> in 1995 performed a retrospective analysis of 100 patients who underwent open heart surgery with the intent to see if atelectasis and post-operative fever were related. Patients were followed through post-operative day two with daily chest radiographs (a total of 190 radiographs taken) and continuous bladder thermometry. He found the incidence of atelectasis increased from 43% (day 0) to 69% (day 1) to 75% (day 2) while the incidence of fever decreased during this same pe-

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**Ronald Guberman, DPM**  
 Director of Podiatric Medical Education  
 Co-Chief, Podiatry Division  
 Dept of Surgery  
 Wyckoff Heights Medical Center  
 Brooklyn, NY



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*Atelectasis (from page 33)*

riod from 37% to 21% to 17% (day 0 to day 2), indicating a lack of association between the two conditions.

To more fully answer this question, in 2011 Mavros<sup>3</sup> and colleagues performed a systematic review that included eight studies, of which one of the studies showed a relationship between atelectasis and early post-operative fever. They determined, "...there is no clear evidence that atelectasis causes fever at all." Similarly, in 2011 Kane and associates<sup>4</sup> found the same to be true for pediatric patients undergoing cardiac surgery. During their retrospective analysis of 203 patients, atelectasis increased during the first three days post-op with no associated fever.

Despite the lack of prospective studies, experts have made it clear that atelectasis is not associated with post-operative fever, stating the following: "Early post-operative fever occurring in the first three days after surgery often requires no further diagnostic work-up other than a review of the patient's history and medications and a focused physical examination."<sup>5</sup>

The obvious next question, then, is: From where does post-operative fever come? Fever, immediately in the OR or within hours after the surgery, includes inflammation from the surgery itself (mediated by IL-1, IL-6, TNF, and interferon gamma), malig-

nant hyperthermia, or a pre-existing infection, while within the first three days is termed early post-operative fever. According to UpToDate<sup>5</sup> the differential diagnosis for fever during the first three days is:

- Continued stress-mediated inflammation as a direct consequence of surgery
- Trauma or burn-mediated inflammation (very specific history that is easy to obtain)
  - Infections pre-dating the operation
  - Myocardial infarction (fever is uncommon with MI but possible with Dressler syndrome or inflammatory pericarditis resulting from the MI)
  - Urinary tract infection (after genitourinary surgery or in-dwelling catheters)
  - Early surgical site infection (especially with Group A Streptococcus and Clostridium perfringens where surgical site infectious signs are also present)
  - Pneumonia (if a history of aspiration during anesthesia or continued intubation post-op)

Note that none of these differentials includes atelectasis.

Let's wrap this up by getting practical. A patient with a post-operative fever in the first three days may or may not have atelectasis, but the atelectasis is NOT the cause of the fever. More likely, the patient has a benign fever resulting from cytokine

release related to the surgery. Perform a detailed history and physical to rule out the other important differentials, and if no obvious cause is noted, then observe and expect fever reduction within a couple of days.

This brings up one last question, and it relates to incentive spirometry. Since spirometry is intended to reduce atelectasis and post-operative fever, and we now know atelectasis is not a cause of post-operative fever, should we stop ordering spirometry? That is a question for another day. **PM**

**References**

- <sup>1</sup> Stark P, Muller NL, Finlay G. Atelectasis: Types and Pathogenesis in Adults. UpToDate. Last update 1/27/2020.
- <sup>2</sup> Engoren M. Lack of association between atelectasis and fever. Chest. 1995 Jan;107(1):81-84.
- <sup>3</sup> Mavros MN, Velmahos GC, Falagas ME. Atelectasis as a cause of postoperative fever: where is the clinical evidence? Chest. 2011 Aug;140(2):418-824.
- <sup>4</sup> Kane JM, Friedman M, Mitchell JB, Wang D, Huang Z, Backer CL. Association between postoperative fever and atelectasis in pediatric patients. World J Ped Genit Heart Surg. 2011 Jul;2(3):359-563.
- <sup>5</sup> Weed H, Baddour LM, Ho VP, Cochran A, Collins KA. Fever in the Surgical Patient. UpToDate. Last update 11/15/2019.

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