Many things can cause otitis media but it usually starts with a cold that is due to a virus. Other conditions may also cause otitis media, such as allergy, swimming, and air travel.

**How does acute otitis media occur?**

The following is the usual sequence of events that occur before an attack of acute otitis media. First, your child catches a cold that is caused by a virus. After a couple of days, the

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**Figure 6–1:** Sequence of events leading to acute otitis media.
infection swells the eustachian tube, which then will not allow enough air to get to the middle ear from the nasopharynx (the back of the nose). Negative pressure then builds up in the middle ear (remember, the pressure in the ear should be close to that of the outside environment). Since the eustachian tube is rarely completely closed and some air can get through, infected secretions can, too—by being sucked up (aspirated) through the eustachian tube into the middle ear. Also, bacteria that normally live in the nasopharynx can get aspirated into the middle ear. The bacteria and viruses multiply rapidly, causing the earache and fever that are the main symptoms of acute otitis media.

**Are there other ways?**

Yes. There are other ways that infected secretions can find their way into the middle ear. Blowing the nose, especially with both nostrils squeezed shut, can force (insufflate) secretions into the middle ear. Also, infants, even without a cold, can easily force air—and infected nasopharyngeal secretions—into the middle ear while crying. Finally, in eustachian tubes that are either too open or too short, or when there is a hole (or tympanostomy tube) in the eardrum, the reflux of infected secretions can get into the middle ear by flowing backwards up the eustachian tube.

**What do these infected secretions do?**

They cause pus to accumulate in the middle ear, which increases depending on the type of bacterium or virus (and how infectious it is) and the ability of the middle ear and the child to fight off (resist) the infection. There is almost always some hearing loss because of the build-up of pus.
Can otitis media spread from child to child?

No. You may think this type of infection can be spread to your child’s siblings or classmates since viruses and bacteria are involved. Otitis media cannot spread but if a child has a cold, then the virus that caused it can spread.

How does otitis media with effusion occur?

Otitis media with effusion develops in much the same way as acute otitis media but there may be relatively few or no bac-

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**Figure 6-2:** Sequence of events leading to otitis media with effusion.
teria in the middle ear. As with acute otitis media, a viral cold causes the nasopharyngeal part of the eustachian tube to swell, and negative pressure develops in the middle ear. As the pressure continues to build up, the walls of the middle ear (which are made of mucous membrane) begin to leak fluid. (Remember the analogy of a finger burned on the kitchen stove?) A thin fluid builds up in the middle ear until it causes hearing loss. Since there are few or no bacteria or viruses in the fluid, however, your child probably will not complain of an earache or have a fever. We sometimes call this condition serous otitis media.

If the fluid lasts for several months or longer, we call it chronic otitis media with effusion, also known as glue ear (because the fluid is so thick it resembles airplane glue) or secretory otitis media.

**Does a cold always cause otitis media with effusion?**

No. Some children and adults are more susceptible to this type of fluid build-up than are others. Recent studies of adults have shown that those who have lifelong poor function of the eustachian tube (meaning they cannot normally open the tube by swallowing) are more susceptible to developing middle ear fluid when they have an upper respiratory infection (such as a cold) than those whose eustachian tubes work well, even when those with normal eustachian tubes have negative pressure that builds up in the middle ear. Since infants and young children often have a dysfunctional eustachian tube, they are most vulnerable to getting otitis media with effusion.

**Do allergies cause otitis media?**

Yes, sometimes. We know that inhalant allergy (such as that caused by ragweed or house mites) in the nose and nasopharynx can cause the eustachian tube to be blocked but
there is no current proof that allergy causes fluid in the middle ear. Nevertheless, an allergy may be a cause of otitis media. Not only can an allergy cause the eustachian tube to swell but your child’s nose is not as open as it should be when the nose becomes swollen with allergy. Remember the little experiment you did in Chapter 5 by pinching your nose shut and swallowing?

We will have more to say about allergies in Chapter 11.

**Can swimming cause otitis media?**

Yes, under certain conditions and in people who are prone to middle ear infections. If your child is not prone to getting ear infections, and does not have an upper respiratory infection, he or she probably will not get one that is related to swimming. Even if your child has had many episodes of otitis media,
swimming on the surface of the water is unlikely to cause another one, as long as he or she does not have a nasal infection.

**But what about swimming with an upper respiratory infection?**

You should keep a child who is prone to getting middle ear infections out of the water during an upper respiratory infection. Swimming under the water, even shallow water, can force (insufflate) secretions from the nose into the eustachian tube and middle ear (and sinuses, too) because of the positive pressure under the water. Diving deep into the water is even more dangerous if your child has a cold since relatively high positive pressure develops very quickly, which can force a large amount of pus into the middle ear, ending in a severe, acute middle ear infection.

Even without an upper respiratory infection, children who have had otitis media usually have ear pain when they dive deep into water since they have eustachian tubes that are dysfunctional. Scuba diving is unwise for anyone who has eustachian tube dysfunction (we will have more on this in Chapter 12).

**Is swimming safe for children with tympanostomy tubes in their ears?**

If your child has a tympanostomy tube (or perforation) in the eardrum, swimming with his or her head under water also can cause otitis media since contaminated water in the ear canal can enter the middle ear through the open eardrum.

**Can flying in an airplane cause otitis media?**

Generally, no. If your eustachian tubes function normally, you feel pressure in your ears when an airplane takes off and lands but not at the cruising altitude; when the plane takes
swimming on the surface of the water is unlikely to cause another one, as long as he or she does not have a nasal infection.

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Figure 6-4: How a normal eustachian tube and middle ear respond during airplane flying.

If you take off and climb, the pressure in the airplane cabin is negative, which makes the pressure in your ears positive (in relation to the outside, which is cabin pressure). Air flows out of your ears...
middle ears and down your eustachian tubes, even when you do not swallow. Then, at the cruising altitude, the pressure in your ears is the same as the pressure in the cabin. But when the plane starts to land, the pressure in the cabin becomes positive, and now the pressure in your ears is negative. To make the negative pressure in your ears the same as the cabin pressure, you must do something to open your eustachian tubes: swallow, move your jaw, yawn, or force air into your middle ears by blowing out your cheeks with your mouth closed and your nose pinched shut. By the time the plane lands, the pressure in your ears is the same as the outside environment: in other words, normal.

**But how does flying affect children who are prone to ear infections or who have eustachian tube problems?**

That is a different story. When the plane takes off and climbs, these individuals rarely have ear pain since most eustachian tubes will spontaneously open. But when the plane starts to land, only actively opening the tube by swallowing (or by the other ways we just described) will make the pressure in the ears match that of the outside environment. And since a child with poor eustachian tube function usually cannot open the tube by swallowing or another way, the negative pressure will stay in the middle ear, causing pain and possibly a build-up of fluid. We call this condition barotitis since the fluid is caused by barotrauma (an injury to the middle ear caused by rapid changes in barometric pressure).

Surprisingly, children who have fluid in the middle ear before the flight rarely complain of ear pain during the flight. This is probably because the middle ear is so full of fluid that the eardrum cannot move to cause pain during takeoff or landing.
Does that fluid then cause a middle ear infection?

Maybe. The fluid that accumulates in the middle ear in the situation we just described is usually sterile (it has no viruses or bacteria in it). However, if your child has had many ear infections in the past, gets an upper respiratory infection, and then flies in an airplane, matters become worse. The eustachian tube problem is not just a failure to open the tube by swallowing; the tube is also swollen due to the virus. Again, there are usually no problems when the plane takes off and climbs but when the plane starts to land, the eustachian tube has just too many problems to open, which results in otitis media. If the tube does finally open, the pus present in the nasopharynx can be sucked up (aspirated) through the eustachian tube into the

Figure 6-6: Infants cry to open their eustachian tubes and force air into the middle ear during descent of an airplane.
middle ear and cause acute otitis media because now viruses and bacteria are in the middle ear.

You will learn in Chapter 12 how to prevent otitis media that is associated with air travel.

**Why do babies often cry while flying?**

As just described, infants most likely experience pain in the middle ear when the plane descends due to the rapid changes in barometric pressure. However, infants remedy this by crying. Their crying probably forces (insufflates) air from the nasopharynx into the middle ear, which relieves the pressure problem. In effect, their crying compensates for their inability to open their eustachian tube by swallowing. Barotitis does not occur very often in infants, probably because they force open their short, floppy eustachian tubes by crying.