SOARING Rx

BY DR. DANIEL L. JOHNSON

Why to Stay on the Ground When Congested

In the Tullio phenomenon
galvanic vestibulocollic responses
indicate that sound sensitivity is likely to occur
distal to the vestibular nerve,
probably at the level of the receptors.
- James G. Colebatch

(All prior columns are at http://tinyurl.com/drdanscolumns)

The Stuffy Head

Jill has spring and fall hay fever – vernal and autumnal allergic oculorhinitis if you want the $100 term – and it's May, the trees are blooming. She's at the gliderport on a lovely, perfect soaring day. She feels good, except that her nose is dripping water, her eyelids itch, and she's turned into a mouth-breather.

Should she fly? How high? Why? Maybe she should roll up two wads of tissue, put one in each nostril, and give a thumbs-up to the wing runner. Add P for Plug to the checklist, eh?

Jack's kids are back in school, that Great Germ Exchange, in September. They have colds and so does Jack. He went through the sneezy part with watery snot, midweek, and now his nose is oozing thick greenish gobs of … um … half-cooked egg white. His voice has turned into a cartoon and his ears crack each time he swallows. But he feels fine otherwise.

Should he get a nose transplant before he flies? Should he tell his student that if a loud scream comes from the back seat, simply to assume that sinus pain has displaced rational thought, and take it as a signal to land?

What to Do?

The simplistic answer, of course, is, "don't fly!" But like most rules, this is a mindless response to what might be a manageable problem. The problem with rules is that they have to be simple, so that men can remember them – but we transgress rationally because they do seem simple-minded, while we feel intelligent, educated, and wise. Well, it feels rational at the time.

Still and all, a long list of bad things can happen to us if we fly with a stuffed up head. At the top of this list are *pain* and *vertigo* (as in the "Tullio phenomenon"). Each may happen because the normal trickle of air can't move to and fro within the small cavities in our head, to ventilate sinuses and middle ears.

I suppose that you agree: having exquisite sharp pain in one ear or in the cheek might distract a person – at least, the *other* person – from careful, safe, considered judgment.

I suppose that you agree: safe maneuvering will be hard if the universe suddenly starts tumbling or spinning while we're trying to fly, or while we're driving home from the airport.

The fact that these things might happen, even if uncommon, are reasons to be part of the ground crew if allergy or infection has stuffed your head. So, that's my simple, mindless advice. Don't fly if your nose doesn't pass gas.

Mitigate the Circumstance

Meanwhile, there are ways to make the situation better, to make it safe to fly. If you're interested in knowing how it works, and what to do, read on.

Illustrations

This discussion works better if you understand the structure of the human head. To save time (harder to find than cash), we'll sponsor a treasure hunt on your own for good illustrations.

You are a skilled user of the Internet, and you can obtain excellent illustrations for this article if you go to images.google.com in each of 2 windows and in one search for "ethmoid sinus" and in the other, "Eustachian tube anatomy." (The method to this madness is that these searches return an excellent collection of anatomy cartoons without much trash. By actual test.)

1: Ventilation of the skull.

The word "sinus" refers to curves (*sinusoid, sine*) or sacs (of blood or air). Venous sinuses are dilated parts of veins, located in various parts of the body. Air-filled (pneumatic) sinuses are in our heads. Why did God make them? I don't know – to make our heads lighter, so they'd float when we swim? So they'd not hang so low when we feel sad? To make our song more resonant?

We have four pairs of pneumatic sinuses. In our cheekbones (*maxillary*), under our eyebrows (*frontal*), in the bumps of bone behind our ears (*mastoid*), and in the center or our head (*ethmoid*). Each of these is lined with mucous membrane, kept moist by secretion of mucus that is continually swept toward the door by microscopic *cilia* to keep them sterile.

The door, the *ostium* of each sinus, is small, and can be occluded by swelling of the mucus membrane that lines it. If this happens, ventilation fails: the air within the sinus is absorbed by the blood and replaced by fluid that exudes from its walls.

The eardrum is sensitive to sound because it's suspended in air: on the outside from the external auditory canal, on the inside through the Eustachian tube, which ventilates the middle ear from the throat.

The external ear canal is pretty big, just small enough not to admit your little finger (see, God *did* understand curiosity), so it doesn't get plugged

easily. The Eustachian tube is small, and normally rests gently closed. This is so that you don't have to hear yourself chew and speak.

Pressure across the eardrum is balanced by opening the Eustachian tube. The *tensor veli palatini* muscle contracts when we yawn or swallow, opening the tube and allowing air into the middle ear. It's possible to learn to contract this muscle voluntarily, which is useful in elevators, airplanes, and in diving. Or yawn a lot, which isn't so good for passengers' contentment.

2: The delicate parts are pressure sensitive.

When the ostium of any sinus is plugged, the air within the sinus is absorbed into the blood stream, and a vacuum forms. If air is not drawn into the sinus, they hurt. This can be severe and distracting. It's always temporary, but can last hours or days or weeks.

If the Eustachian tube is unable to open, a vacuum forms in the middle ear, sucking the eardrum in. This is exquisitely painful until the eardrum ruptures. The pain then decreases. The abnormal pressure can also cause damage or dysfunction to the inner or middle ear.

Major pressure abnormality of the middle ear is important to pilot competence because the inner ear comprises three organs connected by fluid:

- The *cochlea*, the cornucopia that parses sound. When stressed or injured it generates either silence or noise – deafness or "tinnitus." Tinnitus means "ringing" but in reality any sound might be heard except a complex one.
- The *semicircular canals*, three on each side, that detect change of rotation (angular acceleration) in each axis. When distressed, these may induce a powerful, perhaps overwhelming sense of spinning or tumbling, usually with nausea or vomiting. I can't imagine how hard it would be to control an airplane during an attack of vertigo.
- The *otolith apparatus*, one utricle and one saccule on each side, each responding to linear acceleration in two axes. When distressed, these may induce a sense of tossing, tumbling, or imbalance. False turbulence.

As pressure change can disrupt any or all of these senses, even though it happens rarely, we need to add concern for congestion from allergy or infection to our medical pre-flight checklist.

Nasal Decongestants	
Spray decongestants	**Oral decongestants**
Oxymetazoline (more potent, longer acting) Phenylephrine (about 15 brands)	Pseudoephedrine (more effective) Phenylephrine Phenylpropanolamine (restricted*)
	*Rarely causes stroke in women 18-40

3: Dealing with congestion.

Decongestants

The nose contains erectile tissue, in which the blood vessels dilate under nerve control. Normally one nostril is occluded and one open, alternately, in a slow 90-minute cycle. This occlusion is temporary, painless, and seldom noticed. Yes, this does increase with romantic arousal, and isn't noticed then, either. Attention is elsewhere.

With inflammation, blood vessels in the nasal mucosal lining not only dilate, but leak. The leakage creates uncontrolled, persistent swelling, that lasts hours to days, is often painful, and is usually accompanied by fluid dripping from our nose – thick or thin depending on the cause of inflammation.

Certain medications act to constrict the small blood vessels of the nose, permitting the leaked fluid to be reabsorbed, and the nasal passages gradually reopen as the membranes shrink. These are *decongestants*.

When we take a medication continuously, the cellular processes it influences often adjust to its presence, decreasing the therapeutic effect. This change may take days or months, depending on the drug mechanism. In the jargon this is called *tachyphylaxis*. It's important because there's a rebound of the treated abnormality when the medication is withdrawn.

Psychologically, our reaction is to think, "Boy, I really *need* that medication!" because all the symptoms come back worse than before. This is what keeps us taking meds that reduce stomach acid, pain relievers, tranquilizers – and spray nasal decongestants.

I don't know why decongestants taken by mouth don't have this effect. But I do know how this works: a spray nasal decongestant is fine for about 48 hours – and after that its benefit diminishes, and when the decongestant is stopped, the nose plugs up totally and miserably. The chart above, "Nasal Decongestants," lists the medications used for this. Read the fine print on the cold or allergy medication to learn which decongestant, if any, it contains.

What to do:

If you're mildly congested, buy oxymetazoline nasal spray, then clean out your nose, and sniff a couple of sprays in each nostril a half-hour or so before you change altitudes. This lasts about half a day. This is a good single-use strategy for an airplane ride or a trip up the skyscraper or mountain.

If your nose is totally stopped, no

spray will enter. Then, take pseudoephedrine (60 mg short-acting every 6 hours, for an adult) by mouth. If this is incompletely effective, sniff oxymetazoline once or twice.

In general, the decongestants have a mild stimulant effect, so bear this in mind and consider decreasing caffeine to compensate, especially overnight.

Phenylpropanolamine is banned in the US and some other countries because it was found to be associated with stroke in 200-400 women of reproductive age each year. It remains available in some countries, so if you travel, check the fine print or ask the pharmacist.

Housecleaning

With allergy or colds, sometimes annoying inner nasal crusts form. With colds, there's a phase in which snot turns to glue. There is something you can do for this: a saline nasal rinse or spray.

A neti pot is an ancient Yoga device, a sort of teapot which you pour into one nostril and let it run out the other nostril. Use normal saline (for cleansing) or hypertonic saline (for congestion: it shrinks membranes through osmosis).

An alternative is a squeeze bottle, which doesn't require the same acrobatics, such as NeilMed. These commercial devices come with packets of buffered salt that can be used to mix a solution that won't irritate your nose. Do not use tap water. It feels annoying.

4: What to do about allergies.

If you ask, I'll email you my 16-page essay on handling simple allergies but here's the short version.

A: Itchy eyes. Pick up a little bottle of *antihistamine*-containing eye drops. Pull down the lower lid, look at the ceiling, squeeze just one drop onto the lowered lid, let go, and dab the leakage. Now, the other eye. You're good for about 12 hours. Opcon-A™, Visine-A™, Naphcon-A™ (do we see a pattern here?)

B: Sneezy nose: Over-the-counter (OTC), non-sedating antihistamine: loratadine 10 mg daily, fexofenadine 60 mg twice daily. Not cetirizine, chlorpheniramine, diphenhydramine, or anything else.

There's a wonderfully effective but expensive prescription antihistamine nasal spray, azelastine, that acts immediately, lasts all day, and gets around the concerns about spray decongestants [(Astelin™ ($200/bottle), Astpro™ ($175/bottle), generic ($125/bottle)].

Less expensively, there's cromolyn OTC nasal spray that's extremely effective, completely without side effects

(NasalCrom™: 1 or 2 sniffs in each nostril 3 or 4 times a day). There are 2 sizes, .4 oz ($10) and .8 oz ($15). The only catch is that this takes effect slowly, not instantly, so is best used steadily during your allergy season (or the entire time of your life with the cat).

Or you can go to your doctor and get the big expensive guns, which are really not more effective, and your doctor may not know about altitude and alertness issues. It's your money, and we appreciate the support.

5: What to do about a cold.

Handling the sneezy, watery phase of the process.

The first hours of a cold are exactly like the first hours of hayfever or any other nasal allergy: sneezing, nose running with watery stuff like a faucet, itchy eyes. The medical term is *coryza* (ko-REY-zuh). (Some day you can annoy your doctor by saying, "I've got coryza!" He'll roll his eyes and say, "If you're so smart, go to the drugstore and fix yourself.")

Whether this is from allergy or infection, you can turn off the faucet promptly and expensively with Rx-only Atrovent™ nasal spray. (About $125 plus the doctor visit. Yikes! But one bottle will last through many colds.)

Or you can take one of the old-fashioned sedating antihistamines like chlorpheniramine and stay out of the driver's seat, cockpit, and CEO's chair for a couple of days. They somewhat dry up the nose, and somewhat blunt intellect.

Handling the glue phase of the process.

We don't have good drugs for this. Irrigate your nose (see *housecleaning*, above), drink fluids, maybe take guaifenesin, which may or may not liquefy secretions better than lots of water. The daily dose is 1200-2400 mg daily. It's in a lot of cold remedies, but also is available neat. I prefer the single-agent version because it's often combined with other stuff that has unhelpful side effects.

Handling the congestion

Congestion is covered earlier in this essay. If you skipped that part, it's time to hit reverse and look for *Dealing with Congestion.*

6: How to tell if you've done enough (auto-Politzerize).

Dr. Adam Politzer was a Hungarian otologist of the 19th century who developed a technique for introducing air into the middle ear, presumably to relieve the severe pain of congestion. Medical tradition memorializes its history with the names of its pioneers, so when we teach people to put air into their own middle ear, we call it "auto-Politzerization" because it rolls off the tongue so beautifully. And it also makes us sound mysteriously learned.

The need for this is that air generally escapes from the middle ear pretty easily as we ascend, because the Eustachian tube is a finely-shaped cone, pointy side toward the throat. For the same geometric reason, air doesn't easily get back in as we descend. As you may have learned, the ear pain can be exquisite, a distracting thing in the pattern.

Antihistamines for Aviators

Non-Rx	Rx ($$$)
Loratadine (Claritin™) fexofenadine (Allegra™)	Desloratadine (Clarinex™)

If you dive you are surely aware of how to ventilate the middle ear. Increase the air pressure at the back of your throat and simply open the Eustachian tubes by any maneuver that works for you.

· Increase the air pressure in your throat: swallow (slight increase), arch your tongue while blocking your nose at the back with your palate (not hard to do once you've learned the trick – learning does take practice), or simply pinch your nose and try to exhale a bit, not real hard, because high air pressure will simply cause pain in the other direction.

· Open your Eustachian tubes: chew vigorously (slight effect), swallow (moderate effect), or yawn without opening your mouth (may be hard to learn, but is very effective). Sitting around reading *Soaring* magazine is a good time to practice. If you succeed, you'll hear a quiet roaring in your ears like listening to a sea shell, perhaps beginning and ending with a slight crackling noise.

7: Oh, right. What's the Tullio Phenomenon?

It's a rare medical curiosity that's very disabling. The Tullio phenomenon is *vertigo precipitated by sound*. This happens when the bone overlying one of the semicircular canals is damaged, or other damage to the inner ear causes sound vibrations to be transmitted into the semicircular canals. This is rare, and absolutely hinders safe piloting.

I think we might want to talk about the many causes of vertigo next month.