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CLINICAL VIGNETTE

Middle Ear Barotrauma (Barotitis Media)

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Case Reports

The following three cases are examples of the possible effect of sudden increase in external pressure changes to the middle ear and tympanic membrane.

Our first patient is a 30-year-old vacationing male in good health and with no chronic nasal or sinus complaints and no recent upper respiratory infection. After a plane trip from Toronto to Los Angeles, he presented with complaints of right ear pain, a sense of obstruction and decreased hearing. He was afebrile. Otoloscopic examination of the right ear revealed a normal external auditory canal and hemotimpanum. The left side was normal.

He was advised to use 120mg of sustained release pseudoephedrine and oxymetazoline 0.05% nasal spray twice daily. On his own, he also took 20mg prednisone daily for 3 days from his wife's supply. He reported dramatic improvement in his symptoms within 24 hours and complete resolution in 3 days. Of note, despite 3 more plane trips over the next 9 days (Los Angeles to Hawaii, Hawaii to Los Angeles, and Los Angeles back to Toronto), he had no more ear problems. He reported that he was now using the oxymetazoline spray before and during plane trips. He had also learned how to use an effective valsalva maneuver during plane descents.

The second patient is a 23-year-old female student who traveled by plane from Seattle to Los Angeles. She was in good health, had no medical problems and no symptoms of allergy or respiratory infection. She was not taking any medications. She is a long distance runner. She had traveled on planes numerous times previously without incident. This time, however, on the descent she experienced sudden severe pain in her left ear, a feeling of pressure, and reported that her hearing seemed muffled.

On examination, she was afebrile with blood pressure 110/70 and heart rate of 66 beats per minute. The remainder of her physical examination was unremarkable except for a hemotimpanum of the left ear.

She was advised to use pseudoephedrine and oxymetazoline nasal spray daily. She also took ibuprofen for the ear pain. Her symptoms improved over the next seven days. Despite a residual subjective decrease in hearing she decided to risk a return flight to Seattle to resume her studies. She used both the pseudoephedrine and oxymetazoline spray about 45 minutes before her flight and had no reoccurrence of the ear symptoms. Two weeks later she phoned to report that she was back to normal. Since then she has flown several times without incident, but she says she always uses the same two medicines (pseudoephedrine and oxymetazoline) before her flights. She returned for reexamination after 3 months. She was asymptomatic and her eardrum appeared normal.

The third patient is a 21-year-old college student in good health and on no medications. She came to the office complaining of severe ear pain. She had been feeling fine and decided to go swimming. She stated that she had jumped into the deep end of the pool and had the sudden onset of a sharp severe pain in her right ear. She also reported a slight headache and a decrease in hearing in that ear.

On examination she was afebrile with a blood pressure of 100/60 and heart rate of 72. Her entire physical examination was normal except for a right hemotimpanum. She was advised to use pseudoephedrine and oxymetazoline nasal spray daily and to stay out of the pool. Her symptoms resolved over the next several days. On reexamination 4 weeks later her eardrum appeared normal and she was asymptomatic. She had returned to swimming but only on the surface of the water. She stated that she would never again jump into a pool nor even swim underwater.

Middle ear barotrauma can occur when there is a rapid change in the pressure differential between the middle ear and the external environment. These pressures are usually the same due to equalization by the normally functioning Eustachian tube. "This condition was first described in 1783 by a French balloonist named Charles after an ascent to 8800

feet.”¹ In the primary care office, this condition is usually seen in patients who report recent airline travel or diving activities. This is the most common injury reported in divers. (Divers call this “ear squeeze.”) Middle ear barotrauma can occur in 8-17% of airline passengers, and over one third of pilots have reported episodes of this condition^{2,7}.

Commercial flights maintain cabin pressure equivalent to an altitude of 6,000 to 8,000 feet when cruising at altitudes of 30,000 to 35,000 feet. Thus barometric pressure increases as the aircraft descends to lower altitude. For divers, many injuries occur in relatively shallow water as “...there is a significant change in barometric pressure in shallow water. Boyle’s law dictates greater volume change for a given change in depth near the surface than at greater depths.”⁸ Therefore this injury is not limited to deep scuba divers. Our patient had only jumped into a swimming pool¹.

If the Eustachian tube is unable to equalize middle ear pressure to that of an increased ambient pressure in the external ear canal, the tympanic membrane is pulled medially which can result in tissue damage. There can be bleeding into the tympanic membrane, formation of effusion and even rupture of the tympanic membrane^{2,9-11}.

Symptoms of middle ear barotrauma include ear pressure, pain, decreased in hearing (conductive hearing loss), a clogged or full feeling and sometimes bleeding from the external ear canal. Vertigo, tinnitus and sensorineural hearing loss may indicate inner ear barotrauma, a more serious condition which can result in permanent damage^{10,12}.

Physical examination may reveal hemorrhagic streaks of the tympanic membrane, hemotympanum or even rupture of the tympanic membrane¹¹.

Even healthy patients can develop middle ear barotrauma. Those individuals with illnesses involving the nose, sinuses and ears should be advised to avoid air travel and diving sports. Maneuvers that help open the Eustachian tube during plane descent include swallowing, yawning, chewing gum, sucking on hard candy, (or, for infants, nursing or sucking on a bottle). Oral decongestants such as pseudoephedrine, if not contraindicated due to other medical problems, and nasal spray such as oxymetazoline may be of some preventive benefit. Patients should be advised to avoid sleeping on plane descents. Caution is indicated with the valsalva maneuver because a too forceful effort may result in injury to the ear^{2,8,9,13}.

Patients with middle ear barotrauma should be advised to keep the external ear canal dry. Patients usually improve in 3 to 7 days. Medications used for treatment are of uncertain benefit but include analgesics, antihistamines, decongestants, nasal sprays, and steroids. Antibiotics (such as amoxicillin/clavulanate) are indicated for tympanic membrane rupture with purulent drainage. Referral to a Head and Neck specialist should be made for patients with more severe symptoms or tympanic membrane rupture, vertigo, tinnitus, hearing loss^{2,7-11}.

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