

Aerotitis in Air Travel

C. RICHARD WOLF, M.D., Berkeley

■ *In the years 1964-1969, 2,015 cases of aerotitis were reported as an occupational disease in California. Most of the cases were in women flight crew members on commercial airlines (women predominate in such crews). Cases were also reported in passengers. Upper respiratory infection frequently appeared to be a predisposing event.*

THE PRESSURE IN THE MIDDLE EAR normally adjusts to external air pressure changes through the eustachian tube. Failure of this pressure equalization initiates a disease process termed aerotitis by Armstrong.¹ The jet aircraft used in present-day air travel maintain cabin pressure at sea level during flights up to 20,000 feet. On longer flights at altitudes up to 40,000 feet, the cabin pressure would be approximately 6,000 feet. This is enough difference to cause aerotitis. The cause of aerotitis is inadequate ventilation of the middle ear during descent from flight. This may be due to failure of the eustachian tube to open spontaneously, and then inability to open the eustachian tube by deliberate effort.

Edema and reactions of the mucosa secondary to allergy or upper respiratory infections are usually the cause of this blockage of the eustachian tube. The orifice of the eustachian tube then acts as a check valve, letting no air pass into the middle ear if there is sufficient swelling at its opening into the oropharynx. When this occurs during descent from flight, the middle ear has a pressure relatively negative to that of atmospheric pressure. This negative pressure produces a sterile exudate in the middle ear. The exudate and the consequent trauma to the immediate sur-

rounding tissues in the tympanic cavity produce a pathologic state similar to that of serous otitis media.

Diagnosis

The diagnosis of aerotitis requires the following: History of exposure to a situation in which changes in barometric pressure occurred, and physical examination disclosing signs which closely resemble the various stages of otitis media. In the early stages, there will be simply retraction of the drum.

Treatment

The treatment of aerotitis is the same as for otitis media. This includes administration of decongestants and antibiotics. Careful attention during follow-up visits should be directed at watching for recurrence of chronic serous otitis. Further exposure to changes in air pressure should be avoided during the course of the disease. If improvement is not immediate, an ear, nose and throat specialist should be consulted, as myringotomy may be necessary.

Complications

Complications of aerotitis result from infection which rapidly leads to otitis media that is no different than the otitis media of any other cause. Following this, the course of the disease can go

Submitted March 21, 1972.

Reprint requests to: C. R. Wolf, M.D., Medical Officer, Bureau of Occupational Health and Environmental Epidemiology, State Department of Public Health, 2151 Berkeley Way, Berkeley, Ca. 94704.

on to chronic infection or can set up a chronic serous otitis, which has been described by Vogel² as a frequently overlooked cause of deafness. A search of the literature discloses no reports specifically referring to hearing loss as a result of aerotitis in adults. However, Olmsted³ described cases of hearing loss in children as a result of middle ear infection and Beaugard⁴ discussed positional otitis media.

Prevention

Prevention of aerotitis has been basically approached by limiting the speed of descent of aircraft or by controlling the pressurization in aircraft to the point that the pressures between the middle ear and the environment can equalize without blockage. When swelling of tissues owing to upper respiratory infection or allergic reaction prevents equalization by impeding the free exchange of air through the eustachian tube, there are several measures that will help. Collip⁵ studied the use of nasal decongestants in children with otitis media as a therapeutic measure. In commercial air travel, decongestants serve as a means of assisting in equalizing pressure to prevent aerotitis. Swallowing is the standard measure suggested; if this fails, a variation of the Valsalva maneuver is suggested. This maneuver in itself is not without some risk, as Watson⁶ described a relationship of the Valsalva maneuver to chronic recurrent otitis media. In this variation of the Valsalva maneuver, air is forced into the middle ear by forced expiration against a tightly closed mouth and with nose pinched closed. Nasal vasoconstricting agents should be made available to both crew and passengers. Crew members with upper respiratory infections should be grounded. Sufficient sick leave should be granted new employees to insure that they not fly when they have a cold. Passengers with upper respiratory infections should be advised of the risk.⁷ Babies should be awakened and set upright before descent.

Clinical Data

The clinical data contained herein was taken from descriptions of the cases of aerotitis reported by physicians in the State of California to the Division of Labor Statistics on the *Doctor's First Report of Work Injury*. Problems of under-reporting and, on occasion, inaccurate reporting exist and have been studied and reported.^{8,9} On

TABLE 1.—Reports of Aerotitis, California, 1964-1969

| Year | |
|-------|-------|
| 1964 | 170 |
| 1965 | 199 |
| 1966 | 220 |
| 1967 | 309 |
| 1968 | 529 |
| 1969 | 588 |
| Total | 2,015 |

Source: State of California, Division of Labor Statistics and Research, *Doctor's First Report of Work Injury*. Statistics compiled by State of California, Department of Public Health.

TABLE 2.—Reports of Aerotitis by Month of Injury, California, 1964-1969

| Month of Injury | Number | Percent ¹ (adjusted) |
|-----------------|--------|---------------------------------|
| Total | 2,015 | 100.0 |
| January | 232 | 11.4 |
| February | 156 | 8.5 |
| March | 192 | 9.4 |
| April | 162 | 8.2 |
| May | 165 | 8.1 |
| June | 154 | 7.8 |
| July | 110 | 5.1 |
| August | 141 | 6.9 |
| September | 151 | 7.7 |
| October | 147 | 7.2 |
| November | 174 | 8.8 |
| December | 215 | 10.6 |
| Not Reported | 16 | — |

Note: Percents may not add to totals because of rounding.

¹Adjusted for number of days per month.

For source, see Table 1.

the whole, however, these reports make up a great potential source of information about the relative importance of various hazardous conditions not otherwise reported.

Each year in California, physicians report some 30,000 cases of occupational disease. This total figure varies a few thousand from year to year, reflecting the exclusion of specific diseases from reporting categories. Aerotitis has consistently been tabulated and successive years are therefore comparable, as shown in Table 1. The total number of cases reported has been increasing steadily. Our investigations have found no reason other than the increase in commercial air travel. From the reports it appeared that allergic reaction and upper respiratory infections were prime causes of aerotitis.

Table 2 compares the number of reports of aerotitis received by month of injury. This table clearly indicates a trend toward increasing numbers of aerotitis occurring during winter months.

Table 3 shows that of the 2,015 industrial cases

TABLE 3.—Reports of Aerotitis, by Industry, California, 1964-1969

| Year | Industry | | | |
|--------------|----------|------------------|---|-------|
| | Airlines | Other Industries | | |
| 1964 | 132 | 38 | | |
| 1965 | 164 | 35 | | |
| 1966 | 181 | 39 | | |
| 1967 | 266 | 43 | | |
| 1968 | 488 | 41 | | |
| 1969 | 555 | 33 | | |
| 6 year TOTAL | 1,786 | + 229 | = | 2,015 |
| Percent | 88.6% | + 11.4% | = | 100% |

TABLE 4.—Reports of Aerotitis by Sex, California, 1967

| | Employees of Scheduled Airlines | Passengers | Total Reports |
|-------|---------------------------------|------------|---------------|
| Men | 27 (10%) | 43 (100%) | 70 (23%) |
| Women | 239 (90%) | 0 (0%) | 239 (77%) |
| | 266 | 43 | 309 |

of aerotitis reported in the period 1964-1969, 1,786 occurred in airline personnel. Most of the 229 cases in employees of other industries generally occurred in passengers flying on commercial aviation in the course of their regular work. The increase in number of cases of aerotitis throughout the airline industry accompanied expansion in commercial air travel for the same period. Seventy-nine percent of the patients in the industrial cases were women. Far more men than women travel on airplanes in connection with their employment and are thus covered by workmen's compensation. On the other hand women predominate as air-crew employees. Reports summarized in Table 4 reflect this difference in exposed populations. Thus in 90 percent of the 266 cases reported in employees the patients were women. All of the 43 cases reported in passengers were in men.

When an employee's duties involve exposure to air pressure changes, this disease condition requires considerable time lost from work. In

one study group, 71 percent of 1,426 patients lost one to fourteen days from work. There is no clear-cut relationship between the number of scheduled flights by an airline and the number of reports filed by its employees. For example, the airline that had the most take-offs and landings for the study period reported no cases of aerotitis.

Reported cases varied widely from airline to airline, probably reflecting personnel practices regarding sick leave, since our investigations revealed no significant exposure variables that would account for the variance. This was presumed to be a reflection of individual airlines' personnel policies. The cases of aerotitis were treated by many physicians, from all over California, with a treatment pattern consisting usually of antihistamines, decongestants and antibiotics.

An analysis of 309 cases disclosed the following: The right ear was involved as often as the left, and both ears about as often as either individually. Although, usually treated on the day of onset, frequently many days elapsed before the first visit to a physician. Myringotomy was reported in ten instances, but there may have been more that were not reported. Audiograms were done in nine cases but the nature of our reporting system, which discloses only the patient's first visit to the physician, does not permit any conclusions as to resultant hearing loss.

REFERENCES

1. Armstrong HG, Heim JW: Effect of flight on the middle ear. *JAMA* 109:417-421, 1937
2. Vogel VK: Der serose mittelohrkatarrh, eine oft ubersehene Ursache von Schwerhorigkeit, *Dtsch Med J* 13:532-3, 5 Sept 1962
3. Olmsted RW, Alvarez MC, Mornoey JD, et al: The pattern of hearing following acute otitis media. *J Pediat* 65:252-5, Aug 1964
4. Beauregard WG: Positional otitis media. *J Pediat* 79:294-6, Aug 1971
5. Collipp PJ: Evaluation of nose drops for otitis media in children. *Northwest Med* 60:999-1,000, Oct 1961
6. Watson WL: The Valsalva maneuver: Its relationship to chronic recurrent otitis media. *Aero Med Rev* 5:1-8, Jun 1961
7. Medical Criteria for Passenger Flying. A Joint Statement of the American Medical Association and the Aerospace Medical Association. *Arch Environ Health* 2:124-138, Feb 1961
8. Berkov BM, Kleinman GD, Powers JE, et al: Evaluation of occupational disease reporting in California. *J Occup Med* 3:449, 1961
9. Wolf CR, Baginsky E, Milby TH: Patterns in occupational disease. *J Occup Med* 12:1-5, Jan 1970