Allergy and the Ear

Hector P. Rodriguez
MD FACS

Columbia University.
External, Middle and Inner Ear
Allergy and Otology-Diseases

- **External Ear**
  - Atopic Dermatitis
  - Allergic contact dermatitis
  - Dermatophytid (ID) reaction

- **Middle ear**
  - Otitis Media with effusion

- **Inner Ear**
  - Meniere’s Disease
Atopic Dermatitis

- Intense pruritic lesions of the skin
- 5-15% in children, 2-10% in adults
- 75% of cases onset 2-6 months of age
- Itchy, macular erythema with confluent papules progresses to lichenification
- Could affect the flexural surfaces of the neck and extremities
- Secondary infection with staph and Strep usually dx when there is a vesicular eruption
Atopic Dermatitis

- Strong family history in greater than 70% of the patients
- Increase levels of IGE in 80%
- Lower incidence of delayed or cell mediated immune reactions (Dinitrochlorobenzene)
- Diff Dx. Seborrheic dermatitis, scabies
Atopic Dermatitis

- Topical steroids are the mainstay of RX
- Median potency steroid, Flurandrenolide (Cordran) .05% BID
- Server cases short term coarse of steroids
- Antibiotic ointment in patient with secondary infections
- Allergen avoidance, desensitization and antihistamines are of limited value.
Allergic Contact Dermatitis

- Delayed cell mediated response. Prior induction of sensitivity to the allergen. T lymphocytes in the skin
- After re-exposure binding to the antigen presenting cells in the skin may spread to the regional lymph nodes and present with a systemic reaction
Allergic Contact Dermatitis

- Local factors, time of exposure can affect the development of sensitivity
  - excoriated skin
  - Occlusive skin conditions
- Nickel, cobalt, copper, chromium, gold
- Topical medications, neomycin, Bacitracin
- Hearing Aids
Allergic Contact Dermatitis
Allergic Contact Dermatitis
Hearing Aid
Allergic contact dermatitis

- RX
  - avoidance of the offending agent
  - topical steroids
  - antibuse (nickel)
  - Antibiotic ointments when infected
Dermatophyid (ID)

- Allergic skin eruption in sensitized people who have a fungal infection at a site remote from that of the id reaction.
- Commonly affects the external ear
- Common sites of fungal infection include the nails, skin and vagina.
- IGE mediated reaction to fungal antigens
- Trichophyton, Candida and Epidermophyton.
- Desensitization with fungal extracts and yeast free diet.
Allergy and the Middle Ear

- Historically the role of allergy has been suggested in many publications in the 1940 and 1950s.
- The International symposium on OME held in 1999. Not one epidemiologic report from investigators included allergy as a risk factor.
Anatomic Definition of the Middle Ear

- Tympanic Membrane
- Promontory
- ET tube
- Aditus ad antrum
- Epitympanum
Otitis Media Serous vs. Purulent
Physiologic Definition of the Middle EAR

- The middle ear space is a modified sterile gas pocket maintained by bidirectional gas exchange across the middle ear mucosa, Eustachian tube and mastoid cavity.
- The gas composition (CO₂, O₂, N₂) of the middle ear resembles one of venous blood rather than atmospheric air.
Physiology of the Middle ear

- 1 to 2 micro/ liters of gas is exchanged with each swallow
- 100 to 200 swallows per day
- 1 to 2 ml of gas enters the middle ear in a day
- The middle ear and mastoid air space is about 4 to 8 ml.
## Partial pressure of Gases

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Target sites for IGE mediated Hypersensitivity and Otitis Media

- Middle Ear Mucosa
- Nasal Mucosa
- Eustachian Tube
- Nasopharynx
Target sites for IGE mediated Hypersensitivity and Otitis Media

- Middle Ear Mucosa
  - Biomechanical constraints
  - Difficulty of antigen delivery
  - Animal studies show transient edema not effusion
  - Eosinophils and mediators found in middle ear
  - Deposit of circulating immune complexes
Target sites for IGE mediated Hypersensitivity and Otitis Media

- Nasal Mucosa
  - Mucous and inflammatory mediators transported to the Nasopharynx and ET orifice
  - Nasal provocation test increase ET dysfunction but fail to produce OME (Krouse)
  - Temporal bone studies (Luntz)
  - Viral-Bacterial interaction
  - Prolonged effusion N=753 in allergic patients (karma)
Target sites for IGE mediated Hypersensitivity and Otitis Media

- **Eustachian Tube**
  - Decrease in the absorption of nitrogen
  - Does not allow fluid to drain from the Middle Ear

- **Antigen – IGE complexes on the ET**
  - Secondary recruitment of inflammatory cells and mediators of allergy with persistent edema.
Target sites for IGE mediated Hypersensitivity and Otitis Media

- Nasopharynx
- Inflammation of the adenoid and ET orifice
  - IL4 and IL5 cytokines with tissue eosinophilia
Viral infection and Allergy and relation to Otitis media

- RSV and Rhinovirus associated with OM
- Anti virus IGE mediated reaction from mast cells and epithelial cells with release of mediators of allergic inflammation
- LTC4 elevated in RSV infected patients with wheezing
  - Viral infections may be associated with the activation of mast cells
Food Allergy in Otitis Media

- Milk, egg white and wheat
- No studies demonstrating the presence of food immune complexes in the middle ear of children
- Increase in IGG by RAST in middle ear and serum of otitis children
- Food antigen immune complexes can activate complement in the middle ear and cause inflammation.
- Bernstein et al
Otitis Media and Allergy

Summary

- Although allergy itself may not be responsible for the development of OM or OME, it certainly contributes to it.
- The most likely pathophysiologic mechanisms are Eustachian tube blockage causing abnormalities of gas exchange in the middle ear cleft.
- Prolonged inflammation of the ET prevents clearance of middle ear mucous related to viral-bacterial interaction in the middle ear.
Allergy and the Inner EAR

- Meniers
Labyrinth Endolymphatic Sac
Inner Ear and Allergy

- Blood Labyrinthine Barrier
- Immunoglobulin's in the perilymph 1/1000
- Endolymphatic Sac and Duct
  - Fenestrated Blood Vessels (PMA)
  - IGG, IGM, IGA
- Perisaccular connective tissue
  - Mast cells,
  - Eosinophils
  - Plasma cells and macrophages
Meniere’s Disease

- Electronystagmography and Electrocochleography changes have been injected with food extracts during food provocation testing. Some reports also have been seen with nasal provocation testing.
- Circulating Immune complexes have been noted in Meniere’s
Meniere’s Disease

- Allergy and autoimmune disease correlation of 20%. Allergy and Meniere’s disease 41% (N 732 Derebery)
Meniere’s Disease

- Vertigo, hearing loss and tinnitus
- Influx of fluid into the Endolympatic sac with a rupture of Reissner’s membrane in the cochlea
  - Endolymphatic sac the target organ of allergy
  - Antigen delivery through fenestrated blood vessels
  - Reaction of the perissacular connective tissue
Meniere’s Disease

- Histamine potent vasodilatation of the fenestrated vessels
- Circulating immune complex (food antigen) in the endolymphatic sac or in the stria vascularis
- Viral antigen/allergic interaction from previous viral infections in childhood, (mumps, herpes)
- Rx antihistamines, Immunotherapy and elimination diet.
Ultrastructure Cochlea
Indications for allergy testing in patients with Meniere’s symptoms

- Childhood history of allergy
- Family history of allergy
- Patient suspects food reaction
- Other allergic symptoms, rhinitis, pharyngitis
- Failure to respond to conventional treatments
Studies Supporting RX with Immunotherapy and Dietary elimination in the Rx of Meniere’s

- N=93
- RAST, IGE, SET, Subcutaneous (PFT)
- Milk, corn, egg, yeast and soy
- After Immunotherapy 62% reported improvement on all symptoms of meniere’s (vertigo 86%)

Derebery J
Autoimmune Inner Ear Disease (AIED-1979)

- Rapidly progressive hearing loss (weeks to 3 months) with or without signs and symptoms of dizziness or vertigo
- Associated with other immunological diseases in 20% of the time
- Usually bilateral
- RX with high dose steroids
Autoimmune Inner Ear Disease (AIED).

- Audiological Findings
  - Decrease in hearing loss over a short period of time, weeks to months.
  - Decrease in at least two consecutive frequencies of at least ten dB.
  - Fifteen dB decrease in a single frequency.
  - Decrease in speech discrimination of 12% or more.
AIED- Presentation

- AIED usually presents bilaterally or becomes bilateral
- Some patients also have dizziness or true vertigo. Meniere’s-like picture. The hearing loss progresses downward at a very rapid rate, rather than fluctuate
Can the Diagnosis be confirmed with a laboratory test?

- Western Blot for heat shock protein-68, and it has a fairly good sensitivity, although less than 100%. (Predicts the response to steroids)

- Differential diagnosis
  - Other causes of progressive SNHL
  - Meniere’s disease
  - Acoustic neuroma
  - Neurosyphilis
  - Metabolic conditions.
AIED- Treatment

- Long Term Steroids (4-5 months)
- Other (NIH)
  - Methotrexate
  - Enbrel, Imuran
Allergy and Otology

- what is the most common otologic diagnosis you deal with in your day-to-day practice of treating otologic patients for allergic signs and symptoms?

Probably Meniere’s Disease. Some 40 percent of all Meniere’s patients have known skin test positive airborne and/or food allergens.
What about the next most common diagnosis category of patients you see for allergic symptoms?

**Derebery:** The next most common would be chronic serous otitis media. As a conservative estimate, at least 35% of the patients with chronic serous otitis media have allergies as the underlying cause. In fact, as children mature and reach puberty, and have resulting maturation of their Eustachian tubes, the incidence of ongoing allergy causing continual problems actually becomes much higher.
Immunology and Otologic Manifestations

- External Ear
- Middle Ear
- Inner Ear
- Meniere's Disease
- Cochlear and Vestibular Hydrops
- Dizziness
- Tinnitus
Serous Otitis Media
Contact Dermatitis

- Symptoms: Burning, itching, pain
- Signs: Variable. Range from erythema to hyper pigmentation of skin. Fissures with weeping.
- Agents incriminated: Shampoos, hair sprays, perfumes, ear plugs, and earrings. Most common: Nickel allergy to earrings.
- Treatment: Remove allergen. Topical corticosteroids
Eczema

- Symptoms and signs: Itching, scaling, and fissuring: More aggressive forms will present with weeping, crusting, and secondary bacterial infections.
- Predisposing factors: Seborrheic dermatitis, atopic dermatitis, psoriasis, and other skin conditions.
- Treatment: Topical steroid lotions and creams.