Allergic Rhinitis and Asthma

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FRACP Lecture Monday 17th May 2010
1. Background
2. Allergic rhinitis
3. Asthma
Talk Overview

1. **Background**
2. **Allergic rhinitis**
3. **Asthma**
Big deal?
ISAAC 1998
- 463,801 children (age 13-14 years)
- 155 centers, 56 countries
- Self-reported one-page questionnaires (asthma, AR and eczema)
- Video asthma questionnaires (99 centres)

Atopic eczema #12


ISAAC 1998
- 463,801 children (age 13-14 years)
- 155 centers, 56 countries
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Allergic rhinitis
#7


Are rates of allergic disorders really increasing?

**UK trend**

Serial surveys
- AR and eczema *trebled* over last 3 decades

GP consult rates
- Increased for AR by **260%** (1971-91)
- Increased for eczema by **150%** (1971-91)
- Rate of increase declined since the latter part of 1990’s

Are rates of allergic disorders really increasing?

What is the atopic march?

- ‘Natural history’ of atopic manifestations, characterised by:
  - Initial development atopic dermatitis
  - Followed later by development of asthma and allergic rhinitis
- Demonstrated in several longitudinal studies
- Recent evidence suggest that this is observed in boys rather than girls
  - 403 children with eczema in 1st two years of life
  - Asthma increased in boys (OR 2.45) but not in girls (OR 0.88)

The economic impact of allergic disease in Australia: not to be sneezed at. 

- In 2007, the financial cost of allergies was $7.8 billion
- Compare this to:
  - Schizophrenia $1.8 billion
  - Bipolar affective disorder $1.6 billion
The economic impact of allergic disease in Australia: not to be sneezed at. Access Economics for ASCIA, 2007.

- **Breakdown of $7.8 billion cost**
  - $5.6 billion (72%): loss of productivity
    - $4.2 billion = ‘Presenteeism’
    - $1.1 billion = Lower employment rates
    - $196 million = Absenteeism
    - $84 million = Premature death
  - $1.2 billion (15%): direct health system expenditure
  - $262 million (3%): indirect costs
  - $783 million (10%): deadweight loss
Talk Overview

1. Background
2. Allergic rhinitis
3. Asthma
Allergic rhinitis

1. Causes of rhinitis
2. Pathophysiology
3. Classification
4. Clinical assessment
5. Investigations
6. Management
Allergic rhinitis

1. **Causes of rhinitis**
2. **Pathophysiology**
3. **Classification**
4. **Clinical assessment**
5. **Investigations**
6. **Management**
Causes of Rhinitis

Allergic rhinitis (50-70%)
- Symptomatic inflammatory disorder of the nose mediated by IgE antibody in the membrane lining the nose after allergen exposure
- Reversible spontaneously or with treatment

Allergic & non-allergic
- Occupational
  - Chemicals/irritants e.g. manufacturing plants, hair & nail salons
  - Allergens e.g. lab animals (rats, mice, guinea pigs)

Non-allergic rhinitis
1. Infectious – viral, bacterial, other
2. Drug-induced
  - Aspirin-exacerbated respiratory disease
  - Rhinitis medicamentosa

1. Wallace et al. JACI 2008; 122: S1-84.
Causes of Rhinitis

Non-allergic rhinitis (cont)

4. Idiopathic/vasomotor
   - Triggered by tobacco smoke, strong odours, changes in temperature and humidity, exercise, undetermined

5. Non-allergic rhinitis with eosinophilia syndrome (NARES)
   - Subgroup of idiopathic rhinitis
   - Perennial nasal symptoms, particularly nasal congestion
   - Nasal smears demonstrate > 20% eosinophils.
   - Usually middle-aged adults (rare in childhood < 2%)

6. Other
   - Hormonal, emotional, atrophic, food

1. Wallace et al. JACI 2008; 122: S1-84.
Differential Diagnosis

1. Nasal polyps
2. Structural/mechanical factors
   1. Deviated septum/septal wall defects
   2. Adenoidal hypertrophy
   3. Trauma
   4. Foreign body
   5. Nasal tumors
   6. Choanal atresia
   7. Cleft palate
   8. Pharyngonasal reflux
   9. Acromegaly (excess growth hormone)
3. Cerebrospinal fluid rhinorrhea
4. Ciliary dyskinesia syndrome

Wallace et al. JACI 2008; 122: S1-84.
Allergic rhinitis

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Antigen enters via mucosal surface

APC

T_{H2}
IgE Pathophysiology

Antigen enters via mucosal surface

APC

$T_H^2$

IL-4

IL-10

IL-13

B cell

IL-4

IL-10

IL-13

IgE

Ca$^{2+}$

FceRI

Mast cell

Antigen presentation
Pathophysiology of AR

- **Immediate response to allergen**
  - Due to mediators of mast cell degranulation
  - Symptoms – sneezing, watery nose, itch

- **Delayed response to allergen**
  - Due to invasion of inflammatory cells (eosinophils etc)
  - Symptoms – as above plus nasal congestion
Allergic rhinitis

1. Causes of rhinitis
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Old classification system: Time of exposure

1. **Seasonal (outdoor allergens)**
   - Tree pollens: Late winter/early spring
   - Grass pollens:
     - Northern coastal areas: Jan/Feb/Mar
     - Southern coastal areas: Oct/Nov/Dec
   - Weed pollens: August to May

2. **Perennial (indoor allergens)**
   - Dust mite, pet dander, moulds, cockroach

3. **Occupational**

1. Australasian Society of Clinical Immunology and Allergy (ASCIA). www.allergy.org.au
Old classification system: Time of exposure

Problem with this classification

1. Pollen seasons
   - Vary year-to-year with climate change
   - In some areas, pollens and moulds are perennial
   - Some patients with monosensitation to a single pollen species have perennial symptoms

2. HDM allergy
   - Some patients with HDM allergy have only intermittent symptoms (esp Mediterranean area where HDM levels are low in summer)

3. Majority of patients are polysensitized
   - Thus they are exposed to different allergens throughout the year
   - Non-specific irritants (e.g. air pollution) may aggravate symptoms

New classification system: Frequency of symptoms

**ARIA GUIDELINES**

**Intermittent**
- <4 days a week
- OR
- <4 consecutive weeks a year

**Persistent**
- >4 days a week
- AND
- >4 consecutive weeks a year

Classification of severity

ARIA GUIDELINES

1. Sleep disturbance
2. Impairment of daily activities, leisure and/or sport
3. Impairment of school or work
4. Troublesome symptoms

None of the above
   Mild

One or more of the above
   Moderate or severe

Allergic rhinitis

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AR – History

● Symptoms
  ● Nasal
    ● Sneezing, itchy nose & rhinorrhoea
    ● Nasal blockage (may be only symptom)
      ● Mouth breathing and snoring
      ● Sleep apnoea – daytime somnolence, headaches
  ● Non-nasal
    ● Itchy & watery eyes

Wallace et al. JACI 2008; 122: S1-84.
AR – History

- Other symptoms that might suggest AR
  - Recurrent URTI
  - Frequent sore throats
  - Hoarse voice
  - Halitosis
  - Coughing
  - Recurrent serous OM
  - Loss of smell
AR – History

- Other important aspects
  - Chronicity
  - Frequency of symptoms
  - Seasonality: perennial versus seasonal
  - Triggers e.g. pets

- Functional impact on QOL
  - Fatigue, sleep disturbance, learning and attention problems, absenteeism, presenteeism

Wallace et al. JACI 2008; 122: S1-84.
AR - Examination

- **Nose**
  - *Pale, oedematous nasal turbinate mucosa*
  - Excoriation of external nares
  - Allergic salute
  - Transverse nasal crease

- **Eyes**
  - Allergic shiners (SC venodilatation)
  - Dennie-Morgan liners (accentuated folds below lower eyelids)

- **Mouth**
  - High arched palate, mouth breathing
  - Dental malocclusion

*Photo courtesy UpToDate*
Allergic rhinitis

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AR - Investigations

- Tests
  - Skin prick tests
  - Serum allergen-specific IgE

- Basic principles
  - Always correlate with clinical symptoms
  - Positive history + positive test = confirmatory evidence of specific allergy
  - Positive test can occur in the absence of clinical disease → not useful as a screening tool

When to suspect non-allergic causes

<table>
<thead>
<tr>
<th>Clinical feature</th>
<th>Possible cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mismatch between allergy test results and clinical presentation</td>
<td>Non-allergic rhinitis</td>
</tr>
<tr>
<td>2. Mismatch between degree of airflow obstruction and diameter of nasal airway on inspection</td>
<td>Adenoidal hypertrophy</td>
</tr>
<tr>
<td>3. Unilateral obstruction</td>
<td>Structural causes e.g. deviated septum, nasal polyps</td>
</tr>
<tr>
<td>4. Persistent unilateral discharge</td>
<td>In children, foreign body. Rarely, watery unilateral discharge may indicate CSF leak.</td>
</tr>
<tr>
<td>5. Persistent mucopurulent discharge +/- facial pain</td>
<td>Chronic rhinosinusitis or superimposed infection</td>
</tr>
<tr>
<td>7. Loss of sense of smell</td>
<td>Chronic sinusitis or polyps</td>
</tr>
<tr>
<td>8. Poor response to medical therapy for AR</td>
<td>Non-adherence to treatment. Consideration of non-allergic cause.</td>
</tr>
</tbody>
</table>

Allergic rhinitis

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AR - Management

1. Allergen avoidance
2. Pharmacotherapy
   - Antihistamines
   - Intranasal corticosteroids (INCS)
   - Other medications
3. Immunotherapy
AR - Management

1. Allergen avoidance
2. Pharmacotherapy
   - Antihistamines
   - Intranasal corticosteroids (INCS)
   - Other medications
3. Immunotherapy
1. Allergen Avoidance

A. 1. House dust mite
B. 2. Pollens
C. 3. Pet allergens
1. Allergen Avoidance

A. 1. House dust mite
B. 2. Pollens
C. 3. Pet allergens
1A. House dust mite avoidance

- HDM feed on skin flakes contained within dust
- Allergen is contained within faecal particles and body parts of HDM
- Relatively large allergen particle 10-30um
- Remain airborne for short period (20-30 min)
- Mites infest fabrics (bedding)
- Greatest exposure usually in sleep
1A. House dust mite avoidance

- Most important species are:
  - *Dermatophagoides pteronyssinus* (Der p)
  - *Dermatophagoides farinae* (Der f)
  - *Euroglyphus maynei* (Eur m)
  - *Lepidoglyphus destructor* (Lep d)
  - *Blomia tropicalis* (Blo t)

1A. House dust mite avoidance

Current RCH advice

1. HDM encasements – pillow, mattress & doona
2. Remove sheepskin or woollen underlay
3. Remove reservoirs (toys, clothing, furnishings)
4. Remove drapes
5. Every week
   - Wash all bed linen in hot water (>55°C kills HDM)
   - Vacuum carpet
   - Damp dust

?Acaricide sprays

*Ineffective: dehumidifiers & air-filter devices
<table>
<thead>
<tr>
<th>HDM reduction measure</th>
<th>Reduction of allergen levels</th>
<th>Clinical benefit for AR/asthma</th>
<th>Level of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impermeable covers</td>
<td>Some</td>
<td>Some (children with asthma). None (adults)</td>
<td>B</td>
</tr>
<tr>
<td>Washing in hot water (55-60°C)</td>
<td>Some</td>
<td>None</td>
<td>A</td>
</tr>
<tr>
<td>Replace carpets with hard flooring</td>
<td>Some</td>
<td>None</td>
<td>A</td>
</tr>
<tr>
<td>Acaricides and/or tannic acid</td>
<td>Weak</td>
<td>None</td>
<td>A</td>
</tr>
<tr>
<td>Vacuum cleaners with HEPA filters and double-thickness bags</td>
<td>Weak</td>
<td>None</td>
<td>B</td>
</tr>
<tr>
<td>Minimise dust accumulating objects in closed cupboards</td>
<td>None</td>
<td>None</td>
<td>B</td>
</tr>
<tr>
<td>Remove, hot washing/freezing of soft toys</td>
<td>None</td>
<td>None</td>
<td>B</td>
</tr>
</tbody>
</table>

- Evaluated 7 randomised controlled trials
  - Acaricide sprays – 2 trials
  - High-efficiency particulate air (HEPA) filters – 2 trials
  - HDM impermeable bedding – 3 trials
- Reduction in HDM load
  - 6 of 7 trials showed intervention resulted in significant reduction of HDM load when compared to control

- Only 2 of 7 trials were of good quality (investigated mite impermeable bedding)
  - Terreehorst 2003: No significant difference on visual analogue scales, nasal allergen-provocation testing or daily symptom score in 279 patients.
  - Ghazala 2004: Statistically significant decrease in subjective rhinitis and ocular symptom scores in all 26 patients receiving either placebo or active treataments.

- Conclusion
  - Acaricide sprays and extensive bedroom based environmental control programmes may be of some benefit in reducing rhinitis symptoms
  - HDM impermeable bedding used in isolation is unlikely to be beneficial

1. Allergen Avoidance

A. 1. House dust mite
B. 2. Pollens
C. 3. Pet allergens
1B. Pollen avoidance

Pollens

- In Latin, means ‘fine flour’
- Can be
  - Anemophilous - carried by wind
  - Entomophilous - carried by insects
- Pollens nature and numbers vary by
  - Vegetation, geography, temperature, climate, region
- Size
  - Varies from 10 to 100 µm – explains deposition in nostrils and eyes.
  - However pollens can be borne on submicronic particles and induce ‘thunderstorm asthma’

Bousquet et al. ARIA 2008. Allergy 2008: 63 (Sup 86): 8-160
1B. Pollen avoidance

- **Grass pollens**
  - Universally distributed
  - Bermuda (Cynodon dactylon) and Bahia (Paspalum notatum) do not usually cross-react with other grasses
  - Usually pollinate end of spring and beginning of summer

- **Weeds**
  - Mugwort (Artemisia)
  - Ragweed (Ambrosia): end of summer & beginning of autumn
  - Parietaria: pollinates over long periods (Mar-Nov) and can result in perennial symptoms

- **Trees**
  - Birch (Betula), Cypress (Cupressus).
  - Pollinate end of winter and beginning of spring, but varies year-to-year.

Bousquet et al. ARIA 2008. Allergy 2008: 63 (Sup 86): 8-160
1B. Pollen avoidance

1. Avoid going outdoors before midday (if possible).
2. Avoid going out on windy days or after thunderstorms.
3. Wear sun glasses.
4. Avoid activities with high exposure to pollens, such as mowing the lawn (or staying inside when it is being mown). If mowing is unavoidable, wear a mask.
5. Keep windows closed both at home and in the car. Where possible, use recirculating air-conditioning in the car.

Australasian Society of Clinical Immunology and Allergy (ASCIA). www.allergy.org.au
1B. Pollen avoidance

6. Avoid picnics in parks or in the country during the pollen season.

7. Try to plan holidays out of the pollen season or holiday at the seaside.

8. Remove weeds or trees outside the bedroom if particular sensitivities are known.

9. Shower after arriving home and irrigate eyes with wet washer.

Australasian Society of Clinical Immunology and Allergy (ASCIA). www.allergy.org.au
1. Allergen Avoidance

A. 1. House dust mite
B. 2. Pollens
C. 3. Pet allergens
1C. Pet avoidance

- **Pet allergens**
  - Present in high amounts in domestic dust, upholstered furnishings and mattresses
  - Are found in environments where pets have no access e.g. day care centres, schools, public transportation, hospital

- **Dogs**
  - Major allergen: *Can f 1*
  - Principally found in dog’s fur. Also saliva, skin and urine.

Bousquet et al. ARIA 2008. Allergy 2008: 63 (Sup 86): 8-160
1C. Pet avoidance

- **Cats**
  - Major allergen: *Fel d 1*
  - Principal source of allergen are sebaceous glands, saliva and peri-anal glands
  - *Fel d 1* is transported in the air by particles <2.5μm and can remain airborne for long periods
  - Sticks to clothing
  - In Europe, as many as one in four residences posses a cat

Bousquet et al. ARIA 2008. Allergy 2008: 63 (Sup 86): 8-160

Table 16. Effectiveness of avoidance measures in rhinitis and asthma for certain indoor allergens [adapted from Ref. (24)]

<table>
<thead>
<tr>
<th>Measure</th>
<th>Evidence of effect on allergen levels</th>
<th>Evidence of clinical benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove cat/dog from the home</td>
<td>Weak</td>
<td>None: Evidence B</td>
</tr>
<tr>
<td>Keep pet from main living areas/bedrooms</td>
<td>Weak</td>
<td>None: Evidence B</td>
</tr>
<tr>
<td>Use HEPA-filter air cleaners</td>
<td>Some</td>
<td>None: Evidence B</td>
</tr>
<tr>
<td>Wash pet</td>
<td>Weak</td>
<td>None: Evidence B</td>
</tr>
<tr>
<td>Replace carpets with hard flooring</td>
<td>None</td>
<td>None: Evidence B</td>
</tr>
<tr>
<td>Use vacuum cleaners with integral HEPA filter and double-thickness bags</td>
<td>None</td>
<td>None: Evidence B</td>
</tr>
<tr>
<td>Set of allergen control measures</td>
<td>Some</td>
<td>Some: Evidence B</td>
</tr>
</tbody>
</table>