Thunderstorm asthma

SUMMARY

In regions with seasonal high concentrations of airborne grass pollen, thunderstorms in spring or early summer can trigger asthma in people with grass pollen allergy, even if they have not had asthma before.

Seasonal (springtime) allergic rhinitis is the most important risk factor.

Thunderstorm asthma can be life-threatening. People with asthma who are allergic to ryegrass pollen and are not using inhaled corticosteroids (ICS) are at highest risk of death or admission to an intensive care unit.

Thunderstorm asthma prevention

Patients with springtime allergic rhinitis (with or without asthma)

Advise patients to:

- check for alerts about high airborne pollen counts during spring, using a reputable source (e.g., AusPollen)
- check official thunderstorm asthma forecasts in regions where provided (e.g., Victorian Government Epidemic thunderstorm asthma risk forecast)
- avoid being outdoors just before and during thunderstorms in spring and early summer, especially during wind gusts that precede the rain front.

Educate those without asthma to recognise and report possible asthma symptoms (wheeze, tight chest, dyspnoea), and to know how to access a rapid-acting reliever inhaler if needed.

Patients with asthma

Prescribe ICS-based preventer treatment as indicated.

For those allergic to grass pollens who are not already using ICS, prescribe preventive ICS-based treatment in springtime – start at least 2 weeks before exposure to springtime high pollen concentrations and thunderstorms, and continue throughout the grass pollen season.

Update written asthma action plans regularly and ensure patients always have access to rapid-acting bronchodilator relievers.

Epidemic thunderstorm asthma

Thunderstorm asthma epidemics can occur when a storm triggers asthma in many individuals with grass pollen allergy, resulting in a very high demand on ambulance and health services. Epidemic thunderstorm asthma events are uncommon, but occur approximately every 5–7 years in Victoria and some regions in rural New South Wales.

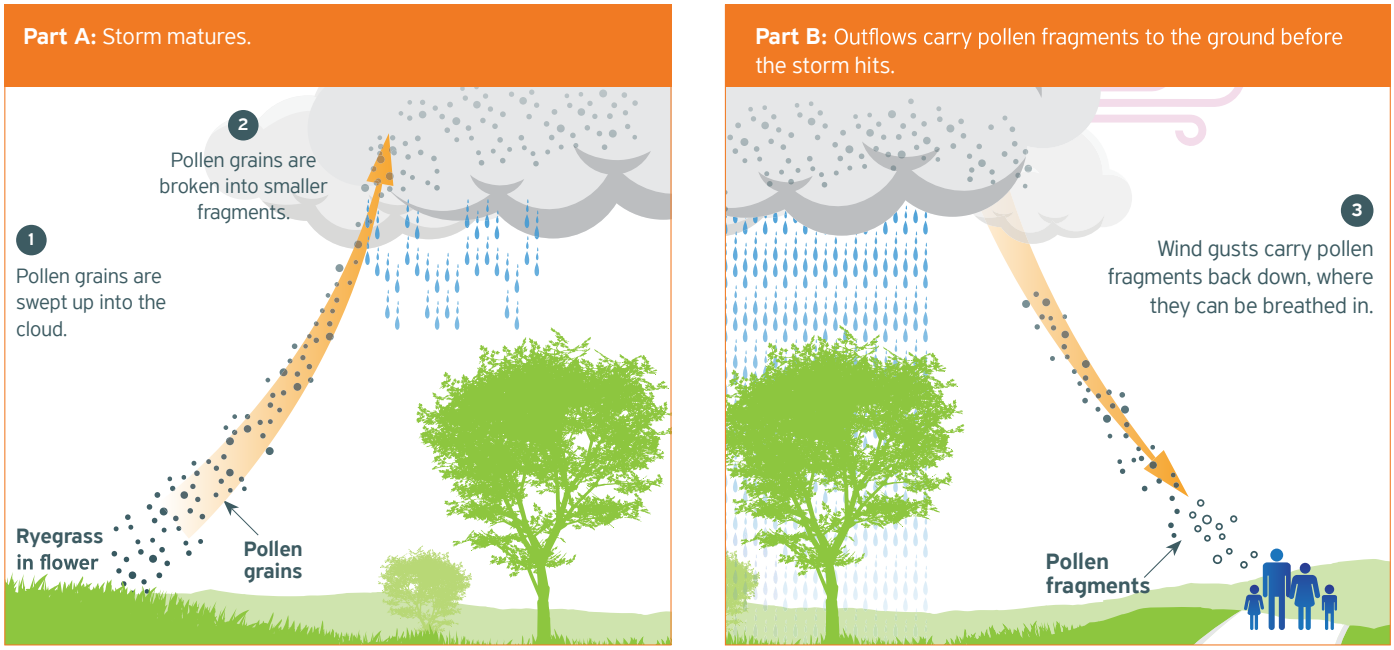
In people with allergy to grass pollens, thunderstorm asthma can be triggered by exposure to a high concentration of pollen fragments in wind gusts just before a thunderstorm (Figure 1). In Australia, this mainly occurs in springtime or early summer in south-eastern mainland regions, and is associated with high perennial ryegrass (*Lolium perenne*) pollen counts.[1]

The main risk factor is seasonal allergic rhinitis (hay fever) – with or without known asthma (Table 1).[1-4] Those who are strongly allergic to ryegrass pollen are at highest risk.[2]

The combination of asthma and grass pollen allergy increases the risk of life-threatening asthma requiring intensive care admission.[5,6] Poorly controlled asthma is associated with the worst outcomes (see Epidemic thunderstorm asthma). Treatment with an asthma preventer that contains ICS appears to be protective.[3,4]

Patients may present with asthma symptoms soon after exposure, or in the following days with an asthma flare-up that they may have been trying to manage on their own.

Figure 1. How thunderstorms increase grass pollen exposure



Grass pollen grains are drawn upwards into storm clouds. Some grains rupture and release many small pollen fragments, which are blown down to ground level on the down-drafts and dispersed across the landscape in the wind gusts that precede the storm.[7,8] Small pollen grain particles inhaled into the lungs can trigger bronchoconstriction in allergic individuals, even if they do not have a diagnosis of asthma.

Table 1. Thunderstorm asthma risk factors[4,6,9,10]

MAIN RISK FACTORS
Seasonal allergic rhinitis occurring in springtime (hay fever), with or without known asthma OR confirmed hypersensitivity to ryegrass pollen (e.g., positive skin prick test or high ryegrass-specific IgE) AND exposure to outdoor air or wind gusts, just before and during a thunderstorm, on a day with high level of airborne grass pollen
RISK FACTORS FOR SEVERE SYMPTOMS (IN ADDITION TO MAIN RISK FACTORS)
Current asthma (especially if poorly controlled)
Not taking an ICS-containing asthma preventer
History of asthma
POSSIBLE ADDITIONAL RISK FACTORS FOR SEVERE AND LIFE-THREATENING SYMPTOMS
Asian ethnic background
Young adult age group

ICS: inhaled corticosteroid; IgE: immunoglobulin E

Allergy testing

Allergy testing (skin prick test or allergen-specific immunoglobulin E/RAST* blood test) is not routinely necessary to identify thunderstorm asthma risk in patients with seasonal allergic rhinitis in south-eastern Australia, but it may be useful for those with perennial allergic rhinitis without obvious seasonal exacerbation.

In temperate regions of Australia, ryegrass is the major clinically relevant allergenic grass pollen for people with allergic rhinitis.[11] Other grass species are more important allergens in subtropical regions.[12]

As a safety precaution in south-eastern Australia, people with seasonal allergic rhinitis should be given preventive advice about thunderstorm asthma (in the absence of allergy tests), because it is reasonable to assume that sensitisation to ryegrass pollen is likely.

For people with asthma, follow Australian Asthma Handbook recommendations for investigating and managing allergies.

*Although standard radioallergosorbent tests are no longer used in most pathology laboratories, the term 'RAST' is still commonly used to refer to specific allergen immunoassays.

Preventing thunderstorm asthma

Patients with asthma

Identify people with asthma and seasonal allergic rhinitis who live in, or visit, regions with high grass pollen levels:

- **Prescribe ICS-containing preventer treatment** as indicated (Table 2) and regularly check adherence and inhaler technique. Most adults and some children with asthma should use ICS-containing preventer treatment.

  Even if ICS treatment is not otherwise indicated for an adult or adolescent with known or presumed ryegrass allergy, it should be commenced well before exposure to springtime thunderstorms in regions with high levels of grass pollen (at least 2 weeks before predicted peak pollen concentrations) and continued until pollens abate (e.g., 1 September–31 December in Victoria).

- **Provide an individualised written asthma action plan** with instructions on what do to when they have asthma symptoms: increase their dose of preventer as well as using their reliever (and start taking systemic corticosteroids, if indicated). Include thunderstorm advice.

- **Warn about the risk of springtime and early summer thunderstorms:**

  Avoid exposure to outdoor air just before and during a thunderstorm in springtime and early summer, especially during wind gusts just before the rain front hits:

  ⚠ *Get indoors with windows closed and turn off air conditioners that bring outdoor air inside (e.g., evaporative systems), shut car windows and recirculate the air. These measures may not completely prevent exposure, so any symptoms should be managed immediately.*

  ⚠ *Watch pollen counts and get thunderstorm asthma alerts in regions where* available.

- **Make sure patients carry a reliever inhaler** (salbutamol or ICS-formoterol), know how to use it when they have asthma symptoms, and replace it before the expiry date or when nearly empty.

For patients with a history of asthma, review whether ICS-based treatment is indicated. Ensure patients either carry a reliever inhaler, or know where to get one when needed (e.g., available over the counter from pharmacies, or in home/school first aid kit), and know how to use it correctly. Provide training in correct inhaler technique, and check technique each year before pollen season. Instructions and videos are available from National Asthma Council Australia. Provide asthma first aid education and written information and, explain when to call an ambulance.

Wearing a P2, P3 or N95 filtering mask may help reduce exposure to pollen allergens,[13] but should not be recommended in place of avoidance. If a mask is poorly fitted, air leakage may occur around the edges (especially with facial hair).[14] Masks can also become ineffective within a short time due to moisture from expired breath.

Practice points

Ask people with allergic rhinitis whether they ever wheeze or have other asthma symptoms during pollen season. These patients may have undiagnosed asthma and may be at high risk for thunderstorm asthma.

People commonly deny or downplay mild asthma symptoms – when patients with a previous asthma diagnosis report that they no longer have asthma, careful questioning is needed to confirm they have experienced absolutely no asthma symptoms (including during exercise).

Consider sociocultural factors when providing asthma self-management education – see Australian Asthma Handbook information on asthma in culturally and linguistically diverse people.

Patients with allergic rhinitis but not asthma

For people with allergic rhinitis sensitised to grass pollens:

- explain how to recognise asthma symptoms and what to do, including how to use a reliever inhaler (ideally with spacer), and provide asthma first aid information including when to call an ambulance
- ensure appropriate access to a reliever inhaler during grass pollen season. Advise patients to either carry a reliever inhaler, or know where to get one when needed (e.g., available over the counter from pharmacies, or in home/school first aid kit)
- warn against being outdoors just before and during thunderstorms, especially in wind gusts that precede the rain front, in grass pollen season (October to December in south-eastern Australia).

Note: Allergic rhinitis should be managed according to current guidelines for adults and children. A treatment plan[15] should be provided. However, there is no evidence that treatment of allergic rhinitis with intranasal corticosteroids will prevent thunderstorm asthma.

Table 2. Summary of recommendations for asthma preventer treatment

ADULTS AND ADOLESCENTS
Current Australian asthma guidelines[16] recommend ICS-containing treatment for all adults and adolescents with any of the following: • asthma symptoms twice or more during the past month • waking due to asthma symptoms once or more during the past month • an asthma flare-up in the previous 12 months. For most patients with newly diagnosed asthma, Australian guidelines recommend either (1) as-needed low-dose budesonide-formoterol taken for symptom relief, or (2) regular daily low-dose ICS, plus as-needed short-acting beta^2 agonist for symptom relief.
CHILDREN 2–11 YEARS
Recommendations for the use of asthma preventers in children are based on the child's age and the pattern of asthma symptoms when not taking regular preventer. Current Australian asthma guidelines[16] recommend that an ICS should be considered for children with frequent asthma symptoms or a history of flare-ups requiring emergency department visits. Start at a low dose and adjust as needed. **For detailed recommendations on preventer doses in adults and children, monitoring, safety and patient education, refer to the Australian Asthma Handbook (asthmahandbook.org.au).**

How to treat thunderstorm asthma

Managing asthma flare-ups

Follow Australian asthma handbook recommendations on managing flare-ups in adults, children aged 6 years and over, and children 1–5 years.

Managing acute asthma

Follow current guidelines for the management of acute asthma in clinical settings:[16]

1. Assess severity (mild/moderate, severe or life-threatening) while starting salbutamol treatment immediately:

- adults and children over 6 years: 4–12 puffs (100 mcg per actuation) via pressurised metered-dose inhaler plus spacer for mild/moderate acute asthma; 12 puffs for severe acute asthma – doses repeated every 20 minutes for first hour; 2 x 5 mg nebules via oxygen-driven nebuliser for life-threatening asthma
- children under 5 years: up to 6 puffs for mild/moderate or severe acute asthma via pressurised metered-dose inhaler plus spacer (with mask if needed) – doses repeated every 20 minutes for first hour; 2 x 2.5 mg nebules via oxygen-driven nebuliser for life-threatening asthma.

2. Give supplemental oxygen therapy, if required, and titrate oxygen saturation to target of 92–95% (adults) or at least 95% (children).
3. Monitor response to bronchodilator therapy and repeat as required.
4. Administer systemic corticosteroids within the first hour of treatment (routinely in adults and children 6 years and over; if inadequate response to salbutamol children under 5 years).
5. Repeatedly reassess response to treatment and either continue treatment or add on treatments as indicated, until acute asthma has resolved (or patient is transferred to an intensive care unit or admitted to hospital). Observe the patient for at least 1 hour after dyspnoea/respiratory distress has resolved.

After the acute episode has resolved, comprehensive post-acute care should be provided and an appointment should be made for thorough follow-up.

Epidemic thunderstorm asthma

Epidemic thunderstorm asthma is an unusual cluster of allergic asthma flare-ups (including severe acute asthma) associated with some thunderstorms in spring or early summer. A large number of people can be affected when a storm concentrates grass pollen allergens and disperses them across a large geographical area in the winds immediately preceding the rain.

Nearly half of all episodes of thunderstorm asthma have occurred in Australia.[9] Six epidemic thunderstorm asthma events have been reported in Melbourne since 1980. Thunderstorm asthma epidemics have also been reported during October and November in Canberra, Newcastle, Tamworth and Wagga Wagga.[2,3,17]

Thunderstorm asthma epidemics occur during peak grass pollen season, which is between October and December in south-eastern Australia. In Victoria the risk is highest around November (from the last week of October to the first week of December). However, the ecological and meteorological effects of climate change may alter this timing. The timing of high airborne pollen concentrations depends on ryegrass flowering and curing, which occurs slightly earlier in NSW and ACT.

Pollen of perennial ryegrass (*Lolium perenne*), a common pasture crop, has been implicated in all Australian thunderstorm asthma epidemics.[2] Fungal spores (e.g., *Cladosporium* and *Alternaria* species) may also contribute to risk for some people, but their role in thunderstorm asthma in Australia is unclear.[2]

The 2016 Melbourne thunderstorm asthma event

What happened

The world's largest and most catastrophic epidemic thunderstorm asthma event occurred in Melbourne and Geelong in November 2016, on a day of extremely high airborne grass pollen concentrations.[3,6]

It resulted in a sudden large surge in emergency ambulance calls, thousands of emergency department presentations and hundreds of hospital admissions.[3] There were 35 intensive care admissions, an almost 10-fold increase in asthma-related hospital admissions, and a more than six-fold increase in respiratory-related presentations to emergency departments, compared with the previous 3 years.[6] Thunderstorm asthma contributed to 10 deaths, including five in people admitted to an intensive care unit.[6]

The majority of patients presenting to health services with thunderstorm asthma did not have a prior diagnosis of asthma[6,18] but almost all had seasonal allergic rhinitis and, where tested, very strong sensitisation to ryegrass pollen.[2,6,18]

All patients who were admitted to an intensive care unit or died had current doctor-diagnosed asthma, and most were not using an ICS preventer.[6]

What we learned

The most important risk factors for thunderstorm asthma were strong allergy to ryegrass pollen[6,10] and, among patients with asthma, lack of ICS treatment.[6]

Other possible risk factors included:

- Asian ethnic background – a high proportion of people who presented to emergency departments with respiratory symptoms or were hospitalised with asthma were born in Sri Lanka, India or southeast Asia.[6]
- age – the mean age of people presenting to emergency departments with respiratory symptoms was 32 years, and the worst outcomes were among adults.[3,6]

More information

Australian asthma handbook

Asthma first aid

National Asthma Council Australia Inhaler demonstration videos and instruction handouts

National Asthma Council Australia Asthma education and training workshops

Australasian Society of Clinical Immunology and Allergy (ASCIA) thunderstorm asthma advice

AusPollen pollen count information

Victorian Government Epidemic thunderstorm asthma risk forecast (Victoria)

Australian Government Bureau of Meteorology and BOM weather app

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Disclaimer

Evidence on the causes and prevention of thunderstorm asthma is limited. National Asthma Council Australia will update information and recommendations as more evidence becomes available.

Although all care has been taken, this information paper is a general guide only, which is not a substitute for assessment of appropriate courses of treatment on a case-by-case basis. The National Asthma Council Australia expressly disclaims all responsibility (including for negligence) for any loss, damage or personal injury resulting from reliance on the information contained herein.

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