Patients with thunderstorm asthma or severe asthma in Melbourne: a comparison

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The Melbourne epidemic thunderstorm asthma (ETA) event of 21/22 November 2016 was unprecedented in size and health impact.[1] There is an urgent need to understand the characteristics of the people who were affected. We therefore sought to characterise the patients with ETA who attended Austin Health, a metropolitan teaching hospital in the northern suburbs of Melbourne, during the event, and to compare them with patients with severe asthma.

The study was approved by the Austin Health Human Research Ethics Committee (reference, LNR/17/Austin/319). All adults who attended the emergency department with a diagnosis of asthma on 21/22 November were offered an appointment with a dedicated ETA clinic. Patients underwent clinical assessment and completed the Asthma Control Questionnaire. Spirometry before and after bronchodilator use, radio-allergosorbent testing (RAST), and skin prick

Characteristics of patients with epidemic thunderstorm asthma (attending the emergency department at Austin Health) or with severe asthma (attending the severe asthma clinic at Austin Health)

	Epidemic thunderstorm asthma	Severe asthma	*P**
Number of patients	31	23	
Age (years), mean (SD)	44 (17)	57 (11)	0.002
Sex (women)	17 (55%)	17 (74%)	0.15
Attended emergency department, 21/22 November 2016	31	0	< 0.001
Admitted to hospital, 21/22 November 2016	1	0	1.0
Asthma medication at 21/22 November 2016			
ICS alone	2 (6%)	0	0.50
ICS and LABA	5 (16%)	23 (100%)	< 0.001
Omalizumab	0	16 (70%)	< 0.001
FEV_1 pre-brochodilator (L), mean (SD)	3.0 (1.1)	1.8 (0.8)	< 0.001
%FEV_1 pre-brochodilator, (SD)	87.3% (17.2%)	66.7% (19.7%)	< 0.001
FEV_1 post-brochodilator (L), mean (SD)	2.9 (1.1)	1.9 (0.7)	0.001
Change in FEV_1, mean (SD)	2.5% (5.5%)	7.2% (7.3%)	0.011
Total IgE (kIU/L), mean (SD)	489 (527)	952 (1585)	0.18
RAST, rye grass (kIU/L), mean (SD)	55.6 (37.5)	10.1 (16.6)	0.022
> 0.35 kIU/L (positive)	26 (84%)	8 (35%)	< 0.001
> 17.5 kIU/L (very high)	22 (71%)	2 (9%)	< 0.001
SPT, rye grass (mm), mean (SD)	10.3 (6.8)	3.8 (2.5)	< 0.001
> 3 mm (positive)	25 (81%)	13 (57%)	0.033
Positive rye grass response, SPT or RAST	27 (87%)	16 (70%)	0.07
SPT, *Cladosporium* (mm), mean (SD)	0.6 (1.3)	1.0 (1.5)	0.44
> 3 mm (positive)	2 (6%)	4 (17%)	0.12
SPT, *Alternaria* (mm), mean (SD)	1.3 (2.4)	1.0 (1.4)	0.47
> 3 mm (positive)	6 (19%)	3 (13%)	0.29
SPT, dust mite (mm), mean (SD)	4.3 (4.1)	4.4 (4.7)	0.91
> 3 mm (positive)	17 (55%)	9 (39%)	0.14
Eosinophil count (10^9/L), mean (SD)†	0.3 (0.2)	0.4 (0.4)	0.07
Fractional exhaled nitric oxide (ppb), mean (SD)‡	37 (26)	35 (30)	0.84
Asthma control questionnaire score, mean (SD)§	0.7 (1.2)	2.1 (1.4)	0.007

ICS = inhaled corticosteroid; LABA = long acting β-agonist; FEV_1 = forced expiratory volume in 1 second; RAST = radio-allergosorbent testing (serum-specific IgE assay); SPT = skin prick test. * Two-tailed *t* test for comparing continuous variables; Pearson χ^2 test or Fisher exact test for comparing categorical variables. † Reference range, < 0.6 × 10^9/L. ‡ Normal, < 25 ppb; intermediate, 25–50 ppb; high, > 50 ppb. § Well controlled, < 0.75; uncontrolled, > 1.5. ◆

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testing for aeroallergens were undertaken, and exhaled nitric oxide, total serum IgE, and peripheral blood eosinophil count assessed. Data for the adult patients with ETA were compared with those of adult patients from our severe asthma clinic who had previously undergone similar testing.

Of 203 patients with ETA who attended the emergency department on 21/22 November 2016, 145 were adults, of whom 31 (21%) attended for follow-up and underwent full assessment by our census date of 22 June 2017. The other patients declined an appointment, failed to attend, or have not yet completed full testing. The demographic characteristics (age, sex) of attendees and non-attendees were similar.

The ETA group had better lung function, fewer current asthma symptoms, and higher levels of sensitisation to rye grass than the severe asthma group (Box). Notably, most ETA patients had a very high RAST result for rye grass ($\geq$ 17.5 kIU/L). Levels of fungal and dust mite sensitisation in the two groups did not differ significantly. The use of inhaled corticosteroids with long acting β-agonists and omalizumab was more frequent in the severe asthma group. Despite their reduced lung function, none of the severe asthma group attended the emergency department or was admitted to hospital during the thunderstorm event.

These results suggest that rye grass pollen was the principal allergen for patients who presented to hospital with ETA. An earlier community study of allergic rhinitis found that a high level RAST result for grass pollen (17.5 kIU/L or more) was associated with a 50-fold relative risk (compared with non-allergic controls) of rhinitis and asthma symptoms when exposed to grass pollen.[2] Combined with our findings, this suggests that a high level positive RAST result for rye grass may be useful for predicting the likelihood of risk of ETA in individuals with allergic rhinitis, with or without asthma.

Omalizumab and inhaled corticosteroids attenuate early and late asthmatic responses to allergen challenge,[3] and inhaled corticosteroids alleviate ETA.[4] We also found that our patients with severe asthma, 70% of whom were sensitised to rye grass, appear to have been protected from ETA by current asthma preventer medications. Because of our small sample sizes, our findings must naturally be interpreted with caution.

Competing interests: Michael Sutherland has received speaking fees from Astra Zeneca. ■

1 Inspector-General for Emergency Management. Review of response to the thunderstorm asthma event of 21—22 November 2016. Final report. Melbourne: Victorian Government, 2017. http://www.igem.vic.gov.au/documents/CD/17/233820 (accessed Sept 2017).

2 Olivieri M, Heinrich J, Schlunssen V, et al. The risk of respiratory symptoms on allergen exposure increases with increasing specific IgE levels. *Allergy* 2016; 71: 859-868.

3 Gauvreau GM, El-Gammal AJ, O'Byrne PM, Allergen-induced airway responses. *Eur Respir J* 2015: 46: 819-831.

4 Girgis ST, Marks GB, Downs SH, et al. Thunderstorm-associated asthma in an inland town in south-eastern Australia. Who is at risk? *Eur Respir J* 2000; 16: 3-8. ■