References

1 Global Burden of Disease Study 2015. Global Burden of Disease Study 2015 (GBD 2015) Results. Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2016. [cited 2016 Oct 27]. Available from URL: http://vizhub.healthdata.org/gbd-compare/
2 MacLachlan JH, Cowie BC. Liver cancer is the fastest increasing cause of cancer death in Australians. *Med J Aust* 2012; **197**: 492–3.
3 Australian Institute of Health and Welfare. Cancer in Australia: An Overview 2014. AIHW Cancer series no. 90. Cat. no. CAN 88. Canberra: AIHW; 2014 [cited 2016 Oct 27]. Available from URL: http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=60129550202
4 The Kirby Institute. National Blood-borne Viruses and Sexually Transmissible Infections Surveillance and Monitoring Report, 2015. The Kirby Institute, UNSW Australia, Sydney, NSW, Australia, 2015. [cited 2016 Nov 11]. Available from URL: http://kirby.unsw.edu.au/sites/default/files/hiv/resources/NBBVSTI%20Surveillance%20and%20Monitoring%20Report%202015_0.pdf
5 The Kirby Institute. Monitoring Hepatitis C Treatment Uptake in Australia (Issue 5). The Kirby Institute, UNSW Australia, Sydney, NSW, Australia, 2016. [cited 2016 Nov 11]. Available from URL: http://kirby.unsw.edu.au/sites/default/files/hiv/attachment/Kirby_HepC_Newsletter_Issue5_2.pdf
6 Alavi M, Law MG, Grebely J, Amin J, Hajarizadeh B, George J *et al.* Time to decompensated cirrhosis and hepatocellular carcinoma after an HBV or HCV notification: a population-based study. *J Hepatol* 2016; **65**: 879–87.
7 Carville KS, MacLachlan JH, Cowie BC. Liver cancer in Victoria, 1982–2007: epidemiological determinants and geographic trends. (Epidemiology Unit, WHO Regional Reference Laboratory for Hepatitis B, Victorian Infectious Diseases Reference Laboratory, Victoria). Updated report. Melbourne: Melbourne Health, Australia; 2013.
8 Supramaniam R, O'Connell DL, Tracey EA, Sitas F. Cancer incidence in New South Wales migrants 1991 to 2001. Sydney: The Cancer Council NSW, 2006. [cited 2016 Nov 11]. Available from URL: http://staging.cancercouncil.com.au/wp-content/uploads/2010/09/A-Pg-1-23-Intro.pdf
9 Australian Government Department of Health. Fourth National Hepatitis C Strategy 2014–2017. Canberra: Australian Government Department of Health, 2014. [cited 2016 Nov 11]. Available from URL: http://www.health.gov.au/internet/main/publishing.nsf/content/A68444CDED77B3A9CA257BF0001CFD80/$File/Hep-C-Strategy2014-v3.pdf
10 Australian Government Department of Health. Second National Hepatitis B Strategy 2014–2017. Canberra: Australian Government Department of Health, 2014. [cited 2016 Nov 11]. Available from URL: http://www.health.gov.au/internet/main/publishing.nsf/Content/C353814FE3255962CA257BF0001DE841/$File/Hep-B-Strategy2014-v3.pdf

Thunderstorm asthma

On 21 November 2016, a large thunderstorm extended over the entire metropolitan region of Melbourne and to the north of the outer suburbs. On that day and the next, emergency services in the city were overwhelmed by cases of severe asthma symptoms.[1,2] By 22 November, two of the patients had died.[1] Four more deaths from severe asthma occurred over the following 5 days, and 8500 patients needed hospital treatment.[3] On 29 November, two more deaths from asthma were reported.[4]

In 2014, mortality from asthma in Australia was 1.6 per 100 000,[5] equivalent to an annual rate of eight deaths in the population of Melbourne at 5.2 million.[6] Deaths from asthma in Australia have been highest in the months of April to October and mainly in the over 65-years age group, in which the statistics are confounded by associated chronic obstructive pulmonary disease. Death rates from asthma are also higher in rural and indigenous communities.[5] Consequently, the 8-day cluster of deaths in November 2016 far exceeds the expected mortality.

Many of the cases of severe asthma had no past history of asthma, although a history of hay fever was commonly reported. A similar but less severe outbreak occurred in Melbourne in the spring of 2010,[7] as well as in Wagga Wagga[8] and Newcastle, NSW. Storm-related asthma epidemics have been reported in countries worldwide, including England, Canada, Italy and Iran,[9–13] attributed to grass pollen in England and Australia and to olive tree pollen in Italy. Counts of airborne grass pollen in Melbourne during November 2016 were in the extreme range on 21 November.[14] Grass pollen counts were even higher on 4, 7 and 12 November, but there is no public record of deaths from asthma on those days. Daily counts of fragmented pollen grains in Melbourne are not available.

Explanations of these events published in the media suggest that airborne grass pollen prevalent in the spring explode during a thunderstorm, producing pollen fragments that can reach the lower airways to trigger bronchoconstriction. Rye grass pollen grains have been shown to release allergen-containing starch granules when ruptured in distilled water.[15,16] Another explanation of the origin of small allergenic particles is that when grass pollen grains become wet they release allergenic glycoproteins through their single pore. Most pollen grains remain morphologically intact when wet, as when stained for microscopic identification. In the dry desert climate of Arizona, we studied allergen-containing

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airborne particles collected by a Burkard spore trap and visualised by microscopy after fluorescence immunoblotting on nitrocellulose.[17] We found that the numbers of small particles that stained for *Cynodon dactylon* grass pollen allergen far exceeded the numbers of the much larger grass pollen grains in any of the transects of the collection tape. So even in the absence of rain, allergenic protein attached to minute respirable dust particles in the PM_{10} range can become airborne. Lack of correlation between airborne pollen counts and airborne allergen from the same species has been confirmed in a study of Plantain pollen.[18]

Thunderstorm asthma has been described as the 'perfect storm', now illustrated in Melbourne by the coincidence of:

1 The geographic location of Melbourne's large population to the south of a very large area of grassland converted from bush habitat to pasture.
2 High velocity north winds during severe weather events in the region.
3 Increasing frequency of severe weather events, attributable to global warming.

During storms all patients with respiratory allergy must avoid outdoor exposure as much as possible. Early warning systems for severe weather events currently appear to be inadequate. Consequently, to minimise the impact of the likely future recurrences, patients with asthma need to take precaution during the grass pollen season (October to the end of January in Melbourne[19]) by substantially increasing their daily anti-inflammatory medication and by carrying bronchodilator inhalers and spacer devices with them at all times. Further study of these outbreaks is needed to determine if most patients with asthma should have an emergency supply of oral corticosteroid, and if patients with allergic rhinitis and grass pollen allergy should carry a bronchodilator for emergency use in the spring and early summer.

In the future, thunderstorm asthma may eventually teach us how to reduce effectively the impact of our dependence on fossil fuel on global warming and severe weather and the impact of our need for grassland used by the cattle and sheep industry on airborne pollen.

Received 21 December 2016; accepted 7 February 2017.

doi:10.1111/imj.13411

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References

1 Calligeros M, Dow A, Donelly B. Thunderstorm asthma: three people critical, 8500 treated in Melbourne hospitals. *The Age* 24 November 2016.
2 Ambulance Victoria. Thunderstorm asthma: two die after Melbourne storm causes spike in respiratory problems. ABC NewsRadio, 22 November 2016.
3 Victorian Department of Health and Human Services. Thunderstorm asthma claims fifth life in Victoria. ABC News, 26 November 2016.
4 Victorian Department of Health and Human Services. Thunderstorm asthma: eighth person dies after Melbourne freak weather event. ABC News, 29 November 2016.
5 Poulos LM, Cooper SJ, Ampon R, Reddel HK, Marks GB. *Mortality from Asthma and COPD in Australia*. Canberra: AIHW; 2014.
6 Population of Melbourne in 2016. Available from URL: http://australiapopulation2016.com/population-of-melbourne-in-2016.html
7 Hagan K. Pollen, storms lead to surge in asthma. *The Age* 26 November 2010.
8 Marks GB, Colquhoun JR, Girgis ST, Koski MH, Treloar AB, Hansen P *et al.* Thunderstorm outflows preceding epidemics of asthma during spring and summer. *Thorax* 2001; **56**: 468–71.
9 Venables KM, Allitt U, Collier CG, Emberlin J, Greig JB, Hardaker PJ *et al.* Thunderstorm-related asthma – the epidemic of 24/25 June 1994. *Clin Exp Allergy* 1997; **27**: 725–36.
10 Elliot AJ, Hughes HE, Hughes TC, Locker TE, Brown R, Sarran C *et al.* The impact of thunderstorm asthma on emergency department attendances across London during July 2013. *Emerg Med J* 2014; **8**: 675–8.
11 Wardman AE, Stefani D, MacDonald JC. Thunderstorm-associated asthma or shortness of breath epidemic: a Canadian case report. *Can Respir J* 2002; **9**: 267–70.
12 Losappio L, Heffler E, Contento F, Cannito C, Rolla G. Thunderstorm-related asthma epidemic owing to Olea Europaea pollen sensitization. *Allergy* 2011; **66**: 1510–11.
13 Forouzan A, Masoumi K, Haddadzadeh Shoushtari M, Idani E, Tirandaz F, Feli M *et al.* An overview of thunderstorm-associated asthma outbreak in southwest of Iran. *J Environ Public Health* 2014; **2014**: 4.
14 Data from spreadsheet provided by Edward Newbigin. Melbourne: School of BioSciences, The University of Melbourne.
15 Suphioglu C, Singh MB, Taylor P, Bellomo R, Holmes P, Puy R *et al.* Mechanism of grass-pollen-induced asthma. *Lancet* 1992; **339**: 569–72.
16 Schäppi GF, Taylor PE, Pain MC, Cameron PA, Dent AW, Staff IA *et al.* Concentrations of major grass group 5 allergens in pollen grains and atmospheric particles: implications for hay fever and allergic asthma sufferers sensitized to grass pollen allergens. *Clin Exp Allergy* 1999; **29**: 633–41.
17 Schumacher MJ, Griffith RD, O'Rourke MK. Recognition of pollen and other particulate aeroantigens by immunoblot microscopy. *J Allergy Clin Immunol* 1988; **82**: 608–16.
18 González Parrado Z, Fernández-González D, Camazón B, Valencia-Barrera RM, Vega-Maray AM, Asturias JA

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et al. Molecular aerobiology – Plantago allergen Pla l 1 in the atmosphere. *Ann Agric Environ Med* 2014; **21**: 282–9.

19 Haberle SG, Bowman DMJS, Newnham RM, Johnston FH, Beggs PJ, Buters J *et al.* The macroecology of airborne pollen in Australian and New Zealand urban areas. *PLoS One* 2014; **9**: e97925.

Successful large volume 'lymphocentesis' for refractory lymphoedema in lower and upper limbs

We read with interest Heng and Hardy's letter 'Large volume subcutaneous lymphoedema drainage'.[1] This case is exceptional with respect to the volume of fluid drained. We would like to add to their letter with a case of similarly large volume lymphoedema drainage ('lymphocentesis') of 11 L in a 45-year-old patient over a 4-day period.

This patient had castrate-resistant prostate cancer with bone metastasis, extensive pelvic nodal disease and gross lymphoedema primarily due to retroperitoneal fibrosis. He had lower limb pitting oedema to his waist, with associated skin tightness and an area of fluid leakage directly from his left calf. Subsequent to the procedure, his mid-calf circumferences decreased by 2 cm on the left and 1 cm on the right. Mid-thigh circumferences decreased by 10 and 4 cm on the left and right respectively. The patient reported a dramatic improvement in mobility and pain, with a marked reduction in the latter from 8 of 10 to 1 of 10 on an 11-point visual analogue scale (VAS); his analgesics were unchanged.

Prior drainages had also removed significant (although smaller) volumes: 1.9 L (from only one foot), 1.5 L (drainage lines blocked by clot) and 4.2 L. Drainages consistently reduced pain scores, by an average of three points on the pain VAS. The largest improvement was proportional to the volume drained.

From the time of the first drainage, the patient lived for 168 days and had no significant procedural complications. Transient fluid leakage after removal of needles did occur, but required only observation and no active intervention. Mild renal impairment was seen; however, the patient was also dehydrated from poor fluid intake and this recovered to normal within 1 week.

We have found subcutaneous drainage to be effective in cancer patients with refractory tense lymphoedema not responding to conventional treatment. In our practice, we have found efficacy across multiple types of metastatic cancer, regardless of cause (e.g. hypoalbuminaemia, lymphadenopathy, radiotherapy fibrosis). However, we have excluded cases with tissue lichenification and only considered the procedure in cases of gross pitting oedema. We have also modified Clein and Pugachev's[2] original procedure by reducing the number of drainage sites from six needles per leg to two; to reduce the risk of entanglement of tubing and falls. Needles are re-sited if drainage is poor.

We also consider drainage in upper limbs if the oedema is refractory to all other treatment, following success in a patient with metastatic breast cancer with refractory gross lymphoedema in her right upper limb. In this case, mid-forearm and wrist circumferences reduced by 2 and 2.6 cm, respectively, and a total of 1 L was drained. Finally, we recommend prophylactic oral antibiotics for 1 week; we believe this low morbidity addition is warranted, although evidence is lacking.

Of interest, we have seen improvement in patient-reported pain and well-being, with even small volumes of fluid drained (50–100 mL). Thus, the place of the placebo effect should be considered in any future research.

In summary, our experience supports Heng's suggestion that drainage may be a useful intervention in patients with refractory lymphoedema.

Received 8 January 2017; accepted 3 February 2017.

doi:10.1111/imj.13410

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References

1 Heng S, Hardy JR. Large volume subcutaneous lymphedema drainage. *Intern Med J* 2016; **46**: 1346–7.

2 Clein LJ, Pugachev E. Reduction of edema of lower extremities by subcutaneous, controlled drainage: eight cases. *Am J Hosp Palliat Med* 2004; **21**: 228–32.

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