

# Preventing out-of-hospital asthma deaths

William F S Sellers

Ten-year-old Cameron Good died from an asthma attack in November 2014; it began during his football match, and news reports highlighted the inability of bystanders to oxygenate before ambulance arrival. Sam Linton died in 2007, Olivia Chandler in 2010, their asthma attacks began at school; the Patient's Association criticised Lauren Hughes' care,<sup>1</sup> and journalist Anthony Shadid's fatal attack was triggered by dander from his horse leading him out of Syria. All parents of the children expressed a wish that something be done to prevent other deaths. Two-thirds of patient deaths from asthma are out of hospital; the UK has the highest incidence of childhood asthma and asthma deaths in Europe<sup>2</sup> and possibly the world. Should epinephrine intramuscular auto-injector 'pens' be used to treat life-threatening asthma, and what other strategies are available?

An All Party Parliamentary Group providing asthma inhalers and training in schools reported in September 2014; inhalers are to be for named use patients only. With greater alacrity and common sense, President Obama passed a Bill in November 2013 to provide training and epinephrine auto-injectors to treat not only anaphylaxis, but also acute asthma, in educational establishments, following deaths from nut anaphylaxis. The Bill acknowledges that both anaphylaxis and asthma require similar treatment. A 'Good Samaritan' clause was included in the bill allowing any pen to be used on anyone else, and protecting inadvertent misdiagnosis. Allergy groups advise carrying at least two 'pens'; not to delay administration, and urgently seek help. Coroner's Inquests, one in the UK<sup>3</sup> and one in Australia,<sup>4</sup> noted that with delay, even multiple intramuscular auto-injections failed to reverse anaphylaxis with acute bronchospasm. Studies in patients with a history of anaphylaxis demonstrated the safety of intramuscular 0.5 mg in adults and 0.3 mg in children.<sup>5 6</sup> This confirms a Virginia House Delegate, Dr Chris Stolle's comment that if a teacher misdiagnosed a temper tantrum as anaphylaxis, no harm will result from an intramuscular injection (and it may give satisfaction to the teacher).

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Available in the UK are 0.15, 0.3 and 0.5 mg EpiPen, and Jext. Anapen was withdrawn in the UK because the needle was deemed too short to penetrate clothing and skin and deposit epinephrine intramuscularly, but remains available in Europe and Canada. Jext has the most powerful springs and longest needle, one spring to force the needle through clothing and skin, and another to inject syringe contents into muscle.<sup>7</sup>

Other strategies for parents and bystanders, when faced with severe bronchospasm (and patient inability to use a metered dose inhaler; MDI), are 'mouth-to mouth' and cardiac massage. Chest compressions are shown to reduce hyperinflation of the chest, remove retained carbon dioxide and aid oxygenation,<sup>8 9</sup> albeit with a risk of barotrauma. Leg raising augments venous return from pooled blood in muscle;  $\alpha$  agonists should be given in hospital when intravenous epinephrine fails to be effective in cardiac arrest or anaphylaxis,<sup>10</sup> by constricting epinephrine-relaxed skeletal muscle vasculature.

Salbutamol inhalers should be used by anybody, on anyone else. Parents could inhale multiple doses from an MDI or a collecting reservoir (as do 'huffers'), and then breathe their expired air into the lungs of their child. The scientific basis for suggesting such a last-ditch manoeuvre is that a large MDI 'puff' produces salbutamol particles, delivered in 16 mL propellant gas. Ninety-nine percent of this volume is HFA134a gas (norflurane, chemically similar to halothane), which relaxes smooth muscle, and is an inhalational anaesthetic agent studied only in animals.<sup>11</sup> This latter effect is appreciated by 'huffers', who collect multiple puffs in plastic bottle reservoirs and then inhale and re-breathe.<sup>12</sup> Up to 12 puffs of a large MDI (192 mL of gas, 1200  $\mu$ g of salbutamol), into a valved holding chamber (VHC) inhaled in one breath is an effective alternative to salbutamol nebulisation, and is used in hospital practice in Australia. Re-breathing is not possible from VHCs. Salbutamol is rapidly absorbed from the sublingual route; an MDI can be directed and discharged under the tongue. It is reassuring that large doses of salbutamol are safe, seen in oral overdose case reports<sup>13</sup> and professional cyclist urine testing. In the latter, if it vastly exceeds

recommended doses it results in a ban from competition. Case reports from Holland of the efficacy of intravenous enoximone, a selective phosphodiesterase inhibitor, in treating life-threatening asthma<sup>14</sup> give hope that an intramuscular or sublingual route may be as effective.

The National Review of Asthma Deaths gave no details of patient care, reporting some deaths had 'guideline' treatment, some not. No advice was forthcoming from the review on medical treatment because there is no UK guideline for the management of life-threatening asthma in or out of hospital.

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