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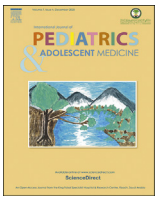

Intravenous and intramuscular therapy in near fatal asthma. A response to Al-Shamrani

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ABSTRACT

The invited review by Al-Shamrani et al. (2020) [1] failed to address the management of a patient having an asthma attack who arrives in the Emergency Department with respiratory failure or in a moribund condition. The only route available for drug therapy in these patients is intravenously (IV) or intramuscularly in a final attempt to reduce bronchoconstriction. This could avoid tracheal intubation and lung ventilation, or make these procedures safer (Sellers, 2013; Williams et al., 1992) [2,3] for the patient if some bronchodilation occurs. Intubation and ventilation prevent coughing but tenacious mucus remains which blocks the bronchi. There are no randomised controlled trials or national asthma guidelines to inform practice at this stage of the disease, especially in under 18 year olds, so case report evidence, experience, common sense, and pharmacological principles must be engaged to save the patient's life.

The order of broncho-dilating drugs should be IV magnesium sulphate 25–75 mg kg^{-1} over about 4 min [4,5]; IV salbutamol 15mcg.kg^{-1} over 10 min [6], or boluses of 5mcg.kg^{-1} over 1–2 min [7]. These doses will quickly achieve a serum level of salbutamol of 20–40 ng.L^{-1} at which full smooth muscle relaxation is thought to occur [8–11]. IV Terbutaline is used in the United States of America (where IV salbutamol [albuterol] is unavailable) to reduce acute respiratory failure in children hospitalised with acute asthma [12]. The use of IV beta2 agonists is unfortunately *proscribed* in the National Institutes of Health 2007 asthma guide [13], stating "No proof of efficacy." IV Enoximone 1–2 mg kg^{-1} is a selective phosphodiesterase inhibitor licenced to reduce vascular smooth muscle constriction in pulmonary hypertension and found to do the same for bronchial smooth muscle [14]. An algorithm which may aid management of life-threatening asthma attacks includes the use of intramuscular adrenaline [15] if there is no intravenous access (Fig. 1). IV Magnesium sulphate ($MgSO_4$) is used in obstetric eclampsia at 4g over 4 min [16], reduces atrial cardiac muscle conduction speed and was used in the past to safely reduce fast atrial fibrillation and supraventricular tachycardia by swift IV administration. In case series, IV doses of 2g over 5 s [17], 15 s [18], 60 s [19,20], and 6g over 6 min [21] are described. The atrial conduction suppression effect is useful to avoid or eliminate the beta1 tachycardia of IV beta2 agonist salbutamol as well as IV adrenaline (epinephrine) [4], and this is the reason it should be given as first IV drug. Flushing and warmth experienced when given IV $MgSO_4$ represents vascular smooth muscle dilatation and is likely to be relaxing bronchial smooth muscle as well. Why a 20 min infusion was chosen for IV MgSO4 (bronchodilation) during asthma attacks has no evidence base and explains why meta-analyses [22] and the large 3 Mg trial [23] failed to show benefit in treatment of acute asthma. With a slow infusion without an initial bolus, a serum level high enough to relax bronchial smooth muscle is not achieved with either IV salbutamol, terbutaline [24,25], or IV $MgSO_4$.

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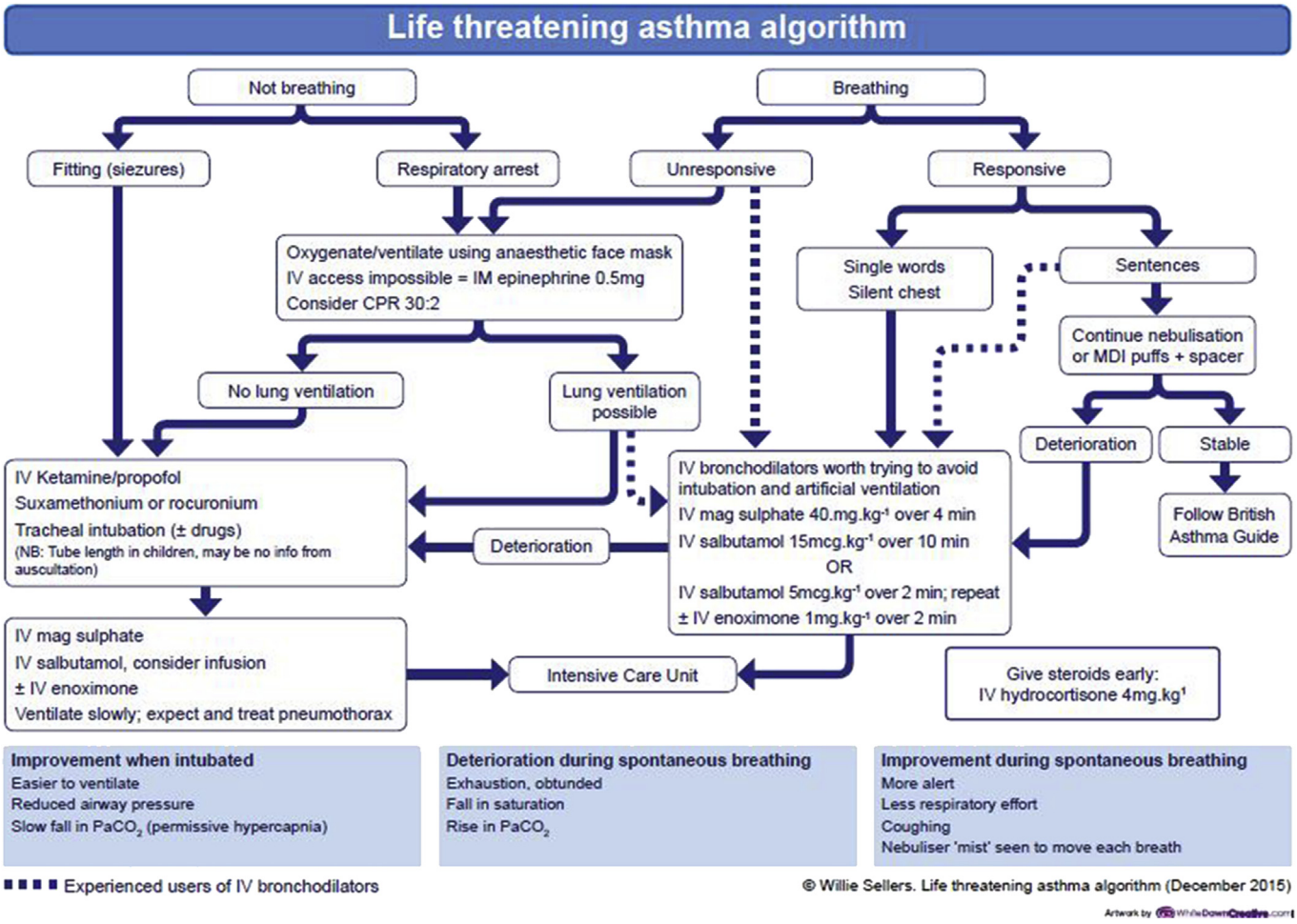

Fig. 1. Algorithm.

Declaration of competing interest

No conflict of interest
Sole work writing and conception.

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