Nebulised Salbutamol in Critical Asthma: Time for a re-think on the practice of ‘in-line’ nebulised salbutamol in intubated patients

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Background

The majority of asthma-related cardiac arrests in the UK occur before admission to hospital. Cardiac arrest in asthma is often a terminal event after a period of hypoxaemia, and is associated with:

- Severe bronchospasm and mucous plugging
- Cardiac arrhythmias caused by hypoxia. (This can also be caused by stimulants including inhaled β2 agonists)
- Dynamic hyperinflation - air trapping and breath stacking as a result of ‘auto-PEEP’ leading to increased intrathoracic pressure, decreased venous return and decreased cardiac output.
- Tension pneumothorax (often bilateral).

Early recognition of deterioration and life-threatening symptoms by patients, their families and the emergency services is key to preventing cardiac arrest in this group of patients.

Current Practice

Nebulised salbutamol is the main treatment option available to ambulance crews for the management of moderate, severe and life-threatening asthma. Intramuscular adrenaline 1:1000 is advocated in life-threatening asthma, especially where anaphylaxis is a possible component. Once the patient is in cardiac arrest crews are generally taught to follow the standard cardiac arrest algorithm, with consideration given to early transportation and management of suspected pneumothorax.

Current practice in some Trusts is to administer nebulised salbutamol through a T-piece adapter to patients in cardiac arrest as a result of asthma. This is advocated as an option in the National Clinical Guidelines (2016), and in a number of Trust-specific clinical guides.

3 An important consideration is that the Human Medicines Regulations 2012 (Schedule 19) allows the administration of intramuscular adrenaline by anyone, but only for the management of anaphylaxis.
The Case for Change

Experience from the LAS Advanced Paramedic Practitioner programme suggests that tension pneumothorax may be common in patients where this has been used. Because tension pneumothorax is a recognised complication in fatal/near fatal asthma it is difficult to know whether there is a direct causal link. However, it is felt that in the manner taught, and in inexperienced hands, in-line nebulisation poses a significant risk of generating high intrathoracic pressures.

The practice of adding a nebuliser between the bag-valve-mask and the endotracheal tube adds approximately six litres per minute of flow into the circuit, effectively creating a very high level Positive End Expiratory Pressure (PEEP), worsening trapping and increasing the risk of barotrauma. This is worsened by bagging where the operator may squeezes very hard against the increased resistance caused by the pathology, as well as the increased pressure generated by the flow through the nebuliser.

Given the relative infrequency of cardiac arrest attendance by ambulance clinicians, and the rarity of asthma and bronchospasm as a precipitating cause (by individual clinician), it is possible that concepts such as permissive hypercapnoea will be missed as clinicians default to standard practice.

Other potential risks include:

- The circuit (as taught) is potentially complicated, and as it is used infrequently, skill decay is potentially an issue in being able to set it up.
- Multiple connections increases the risk of disconnections and failed ventilation
- There is a possibility of equipment being substituted with T-pieces that have one-way valves in them, with potentially fatal results.

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4 The London Ambulance Service has a group of 24 Advanced Paramedic Practitioners selectively tasked to high-acuity and complex incidents to provide enhanced clinical care and support for crews. Cases are identified by an APP in the control-room. Near-fatal asthma would be a very appropriate case to task an APP to.
- In high-stress situations it is possible that crews might focus on this procedure to the
detriment of essential care – IM (or IV) adrenaline and rapid extrication to hospital.

There is doubt as to whether inhaled bronchodilators would be of any benefit in this group of patients,
given the severity of bronchospasm. The 2015 European Resuscitation Guidelines recognises that
whilst nebulised salbutamol ‘is the cornerstone of therapy’ the hypoventilation associated with severe
or near fatal asthma may prevent effective delivery of nebulised drugs’.

At least two Trusts no longer advocate the practice or carry the equipment. Opinion from Ambulance
Service Medical Directors is that if there is a risk or harm, and little chance of benefit, the practice
needs to be reconsidered.

JRCALC considered the recommendation to withdraw this practice. The committee agreed that the
risk of harm should now be considered greater than the likely risk of benefit and the practice
discontinued. Where there is little airflow, the effect of inhaled β2 agonists is likely to be minimal and
when given via a bag-valve system may give false reassurance of the delivery of therapy.

Therefore, on balance, both JRCALC and NASMeD agree that the practice of in line nebulisation
through a T-piece as a therapy for patients ventilated through an Endotracheal Tube patients should
cease immediately.