Correspondence

10 Cumin D, Merry AF, Weller JM. Standards for simulation. Anaesthesia 2008; 63: 1281–4
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Cardiopulmonary arrest in pregnancy

Editor—Dr McDonnell is to be congratulated on the excellent management and successful outcome of the two cases of perimortem Caesarean delivery described in his report. The second of these cases relates to magnesium toxicity and contains some important messages. The serum magnesium concentration of 10.1 mmol litre⁻¹ is the highest blood concentration of magnesium ever reported in a human subject and it is interesting that this patient and her baby made a full recovery. The most likely cause of the cardiac arrest seems to be hypoxia as a consequence of the respiratory paralysis that would be inevitable with this concentration of magnesium in the plasma, but the possibility of direct myocardial depression remains. It is a pity that the clinicians could not decide whether this was a primary respiratory or cardiac arrest as this information would have significantly extended our knowledge of the safety of magnesium infusions. The return of palpable pulses within 1 min of the Caesarean delivery suggests that the arrest was probably respiratory, as the plasma concentration would not have decreased significantly during this brief interval before the restoration of the circulation. Nevertheless, this report of such an exceptionally high magnesium concentration emphasizes the inherent cardiovascular safety of this drug.

However, despite this large cardiovascular safety margin, magnesium sulphate remains a potentially lethal drug because of its ability to produce neuromuscular block. The delivery of large quantities of magnesium from an i.v. infusion bag is potentially extremely dangerous, as this case report illustrates. All of the recent reports of magnesium toxicity have related to exactly this type of administration, where the electronic infusion device intended to be used was either not connected or malfunctioned. In my view, continuous infusions of magnesium should be administered from a syringe pump with appropriate precautions against overdosage, and not from an infusion bag, whatever instructions and precautions are in place to minimize the risk of inadvertent overdose. As magnesium sulphate is currently the drug of choice for the control of eclamptic convulsions, I strongly recommend that i.v. infusions of this drug are administered in a safe, controlled fashion and not through an i.v. infusion bag.

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Editor—I would like to thank Prof. James for his expert comments with regard to this case report. First, to address his comment with regard to the underlying cause of the arrest, I would hypothesize that the underlying pathophysiology was a combination of respiratory and cardiovascular effects of the acute magnesium toxicity. I am of the personal opinion that the loss of cardiac output (as demonstrated by the lack of a palpable pulse and a bloodless surgical field) was likely secondary to marked peripheral vasodilatation from the magnesium, in combination with direct myocardial depression and the dramatic response that was associated with the delivery of the neonate by perimortem Caesarean would support this.

Secondly, we are in agreement with regard to the inherent risks associated with magnesium infusion, especially when it is administered from an infusion bag that contains large quantities of magnesium. After a second recent adverse event at this institution, which is currently accepted but awaiting publication in the literature, the hospital took definitive steps to avoid a potential future occurrence. We examined a number of different options that included administration via a syringe driver, but were reluctant to implement a hospital-wide change in both the presentation and delivery system for our magnesium infusions. Hence, after discussions with the manufacturer of our 8% solutions, we now have this solution provided in 100 ml bags rather than a 500 ml bag. This reduces the total dose that could be administered in the event of an error to 8 g, as opposed to 40 g which could be administered from the 500 ml bag. We accept that other institutions may prefer to switch to administration via a syringe driver. We would advise that whatever system is utilized, it must be ensured that the magnesium solution itself does not contain a large amount of magnesium, as programming and
device errors may still occur no matter what administration system is in place. We also suggest that calcium is readily available in locations where magnesium is administered and that all staff are familiar with the management of acute magnesium toxicity.

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Continuous flow positive airway pressure generator in critically ill patients

A recent article by Glover and Fletcher\(^1\) assessed the performance of a continuous flow positive airway pressure generator (Whisperflow: Philips Respironics) which was bench-tested under dynamic conditions that simulated many clinical circumstances. We have also assessed the performance of two continuous flow positive airway pressure generators (Adjustable Downs Flow Generator-Vital Signs and the same Whisperflow).\(^2\) We also found a poor performance of the Whisperflow generator under dynamic conditions, especially when those conditions were more demanding.

In view of the above studies and the considerations below, we believe that the use of such generators is unjustifiable. Besides the underperformance of the Whisperflow generator, there are some other reasons that should preclude the use of continuous flow positive airway pressure generators in critically ill patients. In our country (Brazil), simple turbine-driven CPAP machines have similar acquisition cost to flow generators. Even if this does not apply worldwide, the increased cost of a preventable adverse event would wreck the economic argument.\(^3\) In our experience, the noise of generators is high enough to bother patients and intensive care unit staff, with probable negative impact in patients’ sleep\(^4\) and delirium. A recent study measured the noise of two CPAP systems (including Whisperflow) and it reached more than 90 dB depending on the interface\(^5\) (similar to a food blender at 1 m distance). In addition, continuous flow generators do not offer indispensable alarms and monitoring.

As these two studies\(^1\)\(^2\) have demonstrated, the number of possible factors that can be adjusted in a continuous flow generator (fraction of O\(_2\), pipeline supply, valve load, and flow adjustment) makes the performance excessively variable and unpredictable. We fully agree with Glover and Fletcher that further in vivo data are required, but due to the low efficacy and serious concerns about safety, we believe that we should consider a moratorium on the use of continuous positive airway pressure flow generators in critically ill patients.

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Editor—We are grateful to Caruso and colleagues for their interest in our paper.\(^1\) They present persuasive arguments against the use of continuous high-flow CPAP generators (HFCPAP) in the critically ill, specifically the Whisperflow (Philips Respironics).

As demonstrated by both our and Caruso’s studies, the in vitro performance of this device is sub-optimal.\(^1\)\(^2\) Furthermore, there are clinical data indicating that CPAP in general may increase work of breathing and worsen outcome in hypoxaemic respiratory failure.\(^6\)\(^7\)

While we are inclined to agree with Caruso’s proposal for a moratorium on the use of the Whisperflow and similar devices, we must carefully consider the possible consequences.

In the UK, the use of HFCPAP systems is widespread and indeed the Whisperflow is being promoted for pre-hospital use. Use is often by non-intensivist physicians and therapists in patients with a wide range of causes of respiratory failure. The Whisperflow is used on the basis of low cost, simplicity and in the belief that it is effective and suitable for use by those without advanced critical care training and sometimes without close monitoring. If we prohibit this kind of use, then demand for ‘formal’ critical care support will increase in an unsustainable fashion. Conversely, it could be argued that the usage of non-invasive ventilatory support outside the critical care unit has always been inappropriate and has arisen because of resource limitations.

Non-invasive respiratory support has been one of the great advances in critical care, and yet it must be used with care. As with any device, it is vital that the user is fully aware of the limitations of the technology. Currently, this is not the case. This is largely because formal evaluation of these devices before marketing is not mandatory. It is only now through the work of Caruso, ourselves, and others that we are beginning to understand the performance of HFCPAP generators. The next generation of work must look at the patient’s respiratory support requirements also. This is a largely neglected area of study.