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Lubrication of the i-gel supraglottic airway and the classic laryngeal mask airway

In the randomised crossover trial comparing the i-gel with the classic LMA, by Janakiraman et al. [1] we noticed an error. In this study, it was stated that, 'Both devices were lubricated using Aquagel (Adams Healthcare, Leeds, UK) on the tip and posterior surface as recommended by the manufacturers'. However, the correct procedure for lubricating the i-gel, as detailed in the i-gel Instructions For Use [2] and User Guide [3] and supported by photographic images, is to, 'Grasp the i-gel along the integral bite block and lubricate the front, back and sides of the cuff with a thin layer of lubricant'. The i-gel is manufactured from a soft thermoplastic material, which is naturally tacky until lubricated. It is therefore essential that the device is lubricated correctly, as described in the instructions for use, in order to ensure patient safety and optimum performance.

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A reply

We can confirm that the i-gels used in the study were only lubricated on the tip and posterior surface as stated in the study and not also on the anterior surface as recommended by the manufacturer. However, we do not believe, had the recommended lubrication technique been used, that this would have caused a significant change in the main finding of the study, namely that some patients require a larger size of i-gel than indicated in the instructions for use to provide an adequate seal.

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Mitigation of rocuronium-induced anaphylaxis by sugammadex: the great unknown

Intra-operative anaphylaxis has been estimated to occur in between 1 in 3500 and 1 in 13 000 cases [1]. Neuromuscular blocking drugs account for 55–69% of cases of peri-operative anaphylaxis, and the most commonly-implicated drugs are suxamethonium and rocuronium [2, 3]. Rocuronium-induced anaphylaxis is probably more common in certain countries, such as France and Norway, than it is in North America [1, 4].

The treatment of anaphylaxis is familiar to all anaesthetists [1]. Anaphylaxis is not an all-or-nothing phenomenon, and the continued anaphylactic response may rely, to an extent, upon the continued presence in the body of the culprit antigen [5]. Consequently, a standard treatment involves the prompt elimination of ongoing patient exposure to the offending antigen [1, 5]. In the case of most intravenous drugs, it is impossible to eliminate exposure to the drug that is already in the patient's blood, and the remaining drug may continue to sustain the anaphylactic response until its elimination by the body.

In the case of rocuronium-induced anaphylaxis, there may exist a novel treatment strategy that aims to prevent propagation of the anaphylactic response by rocuronium molecules already in the patient's blood. By administering sugammadex (a novel selective binding agent that avidly encapsulates rocuronium [6]), it may be effectively possible to 'remove' free rocuronium molecules from the circulation, and hence slow down or halt the immunologic process. Of course, this speculation relies upon the assumption that sugammadex-bound rocuronium will no longer initiate cross-linking of cell-bound IgE, which may be true given that sugammadex almost completely encapsulates the rocuronium molecule [6]. This encapsulation may disrupt the structural orientation of rocuronium that is necessary to cause IgE cross-linkage, and hence, disrupt propagation of anaphylaxis.

Several aspects of this potential treatment need to be considered. First, the antigenic portion of the rocuronium molecule containing the ammonium group actually protrudes from the sugammadex molecule [6]. This may mean that the portion of the rocuronium molecule responsible for IgE cross-linkage (and thus anaphylaxis) may still be able to contact (and cross-link) IgE. Second, since sugammadex binds aminosteroid molecules, there is a theoretical potential for sugammadex to bind other steroid molecules (such as the corticosteroids universally used to treat anaphylactic reactions), which would be undesirable. However, sugammadex has exhibited an affinity for other steroid compounds (such as aldosterone, cortisone, or hydrocortisone) that is at least 120 times lower than its affinity for rocuronium [7]. The clinical importance of this potential interaction is unknown.

Although a case of treatment of rocuronium-induced anaphylaxis by sugammadex has not been described, there may be sufficient pharmacologic and pathophysiologic rationale to consider administration of sugammadex to a patient with anaphylaxis if traditional treatment is failing and there is a high index of suspicion of rocuronium being the causative agent. Since the goal of administering sugammadex in this context would be to bind all molecules

of rocuronium as quickly as possible, the dose of sugammadex required may well be high (up to 16 $mg.kg^{-1}$ [8], depending on the dose of rocuronium given). It is important to stress that administering sugammadex in this circumstance would be an off-label, unapproved indication, and that the first priority of treatment of any suspected anaphylactic reaction should be the implementation of well-established therapies [1] with consideration of other options, only if these therapies do not prove effective.

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A reply

Drs Jones and Turkstra raise an intriguing question: will the intravenous administration of sugammadex mitigate ongoing anaphylaxis due to rocuronium? If this strategy is to be effective, several criteria must be fulfilled. First, the anaphylactic reaction must be rocuronium-induced. This would appear to be self-evident, but the causative agent is incorrectly identified at the time of the reaction in approximately one-third of cases. Second, it would be necessary for the concentration of rocuronium at the effect site (tissue-bound mast cells and circulating basophils) to fall rapidly as a result of encapsulation by sugammadex. Third, it would be advantageous if the affinity of sugammadex for rocuronium exceeds the affinity of the complementary cell-bound IgE antibodies. Fourth, it would be necessary for the process of encapsulation to hide the epitope responsible for rocuronium-induced anaphylaxis. Fifth, it would be necessary for the relevant endogenous and exogenous steroids to be preserved in concentrations that would favour homeostasis.

There are many uncertainties. It is not known which parts of the rocuronium molecule are responsible for antibody cross-linking [1], although it is known that substituted ammonium ions are central to the process. It is not certain whether the IgE antibodies form a homogeneous group: it is likely that more than one sensitising agent may be involved. The plasma half-life of the sugammadex-rocuronium complex exceeds that of the naked rocuronium molecule [2] and, if the allergenic determinant remains exposed despite the embracing sugammadex molecule, the allergenic determinant may persist in the circulation for longer than would otherwise be the case, with the attendant possibility of exacerbating the anaphylactic reaction.

There is clearly much to be learned before sugammadex can be used in the management of rocuronium-induced anaphylaxis. In the meantime the 2009 Association of Anaesthetists of Great Britain and Ireland Safety Guidelines provide the most appropriate advice for managing anaphylaxis during anaesthesia [3].

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Severe bronchospasm or anaphylaxis?

In response to the recent anaphylaxis guidelines [1], we would like to report a case of severe bronchospasm misinterpreted as anaphylaxis. A young adult female presented for removal of a cervical spine tumour. Following induction of anaesthesia, she received vecuronium and ventilation by bag/mask was initially easy. After tracheal intubation, cefuroxime was administered and a throat pack inserted. A combination of bronchospasm and severe hypotension immediately ensued, and whilst no urticarial rash developed, a diagnosis of anaphylaxis was made. Cefuroxime was identified as the likely precipitant as it was administered immediately before the onset of symptoms. She received prompt

