

CORRESPONDENCE

Sugammadex-induced bronchospasm during desflurane anaesthesia: an open question

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Editor—With great interest, we read the letter by Baronos and colleagues¹ reporting a case of bronchospasm that occurred after the administration of sugammadex for reversal of rocuronium-induced neuromuscular block during desflurane anaesthesia in a patient with no history of pulmonary disease. Interestingly, isolated bronchospasm occurred without manifestations of hypersensitivity or an allergic reaction and over a short duration, which allowed tracheal extubation without post-surgical consequences. The authors hypothesised a potential role of sugammadex in eliciting bronchospasm.¹ However, we would like to comment on this clinical interpretation.

Bronchospasm can occur after activation of the parasympathetic nervous system or a neural network in the lungs, known as the non-adrenergic non-cholinergic (NANC) nervous system, by a noxious stimulus.^{2,3} In the first mechanism, the trigger directly stimulates afferent vagal sensory fibres and activates a vagal reflex with final release of acetylcholine, which acts on M3 muscarinic receptors and results in bronchiolar smooth muscle contraction.² In the second mechanism, the triggering factor, mainly proinflammatory mediators, stimulates NANC unmyelinated C-fibres, resulting in the release of neuropeptides via axon reflexes. These neuropeptides, such as substance P, neurokinin A and B, and calcitonin gene-related peptide, induce airway smooth muscle contraction.³

When isolated bronchospasm occurs in a patient without pulmonary disease, hypersensitivity, or anaphylaxis, and without administration of risk-promoting drugs (e.g. i.v. beta-blockers, cholinesterase inhibitors, histamine-releasing drugs), vagally-induced bronchospasm should be considered.⁴ Mechanical stimuli, such as tracheal intubation, secretions, soiling, suctioning, pulmonary aspiration, and surgical stimulation, which may or may not be associated with inadequate anaesthetic depth, can elicit neurogenic bronchospasm through direct activation of the parasympathetic nervous system.^{4,5} Of 4000 bronchospasm incidents reported in Australia, 103 reports were related to perioperative bronchospasm (3%). Furthermore, a non-

allergic mechanism was more frequently observed (79%) than an allergic mechanism (21%).⁵ Among the 81 non-allergic cases, 44% occurred during anaesthesia induction (64% were idiopathic or presumed to be the result of airway irritation from laryngoscopy, intubation, or both; 17% were attributable to tracheal tube displacement), 36% occurred during anaesthesia maintenance (31% were the result of tracheal tube problems), and 20% occurred during recovery from anaesthesia (38% were idiopathic).⁵

Sugammadex is a modified γ -cyclodextrin that was developed as a reversal agent for aminosteroid neuromuscular blocking agents, particularly rocuronium, and acts by encapsulating unbound rocuronium to form tight 1:1 complexes that are inactive.⁶ Thus, this mechanism-of-action does not involve an interaction with the cholinergic system.⁶ Furthermore, sugammadex has not been found to affect the contractile function of bronchial smooth muscle in rats.⁷ Although described, bronchospasm directly related to sugammadex seems to be an unusual event in patients without pulmonary disease; when present, it would be expected to be related to hypersensitivity or anaphylaxis and is typically observed with higher doses of sugammadex.^{5,8}

Desflurane is a short-acting volatile anaesthetic agent. The potential for desflurane to alter respiratory mechanics remains a matter of debate. In isolated guinea pig trachea, desflurane administered at 0.5–1 minimum alveolar concentration (MAC) markedly attenuated cholinergic contractions, most likely by inhibiting acetylcholine release and directly interfering with the intracellular contractile processes of airway smooth muscle cells.⁹ In rabbits, desflurane 1 MAC exerted bronchoprotective effects against methacholine-induced bronchoconstriction, which were independent of the severity of bronchospasm or the presence of hyperresponsiveness.¹⁰ In adult humans, desflurane at 7 vol% inspired concentration in oxygen–air exhibited no bronchodilator activity. Instead, respiratory system resistance increased by 5% in the 10 min after desflurane administration.¹¹ In patients undergoing elective surgery, significant increases in both total and airway resistance were observed at desflurane 1.5 MAC, but not at

1.0 MAC, with return to near baseline values after discontinuation of the agent.¹² This dose-dependent, reversible increase in resistance has also been shown in animal studies in which desflurane modifies the vagal efferent pathway by both central and peripheral reflexes.¹³ In guinea pigs, desflurane increased lung resistance mainly by stimulation of NANC unmyelinated C-fibres, inducing the release of tachykinins (neurokinin A, substance P, or both) antidromically via axonal reflexes.¹³ In a follow-up study using the same animal model, desflurane activated the irritant gas receptor transient receptor potential A1 on NANC unmyelinated C-fibres, resulting in release of contraction inducing tachykinins and thereby evoking bronchoconstriction.¹⁴ In clinical practice, desflurane can trigger bronchoconstriction in some circumstances and is not always protective against neurogenic bronchospasm, particularly in patients who smoke.¹¹

Inhaled, short-acting β -adrenoceptor agonists and parenteral corticosteroids are considered the mainstay of treatment for acute bronchospasm.⁵ However, in light of a possible neurogenic mechanism, an anticholinergic drug,^{4,5} such as inhaled ipratropium bromide,¹⁵ should be considered.

Both desflurane and sugammadex are widely used in operating rooms, often in combination. We agree with Baronos and colleagues¹ that further research is necessary to determine the safety profile of these agents, especially when administered together. Caution should be exercised when using these drugs while awaiting further data.

Declaration of interest

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Association of age with accuracy of surgical pleth index to predict major postoperative pain

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