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Review

Comparison of recovery parameters for xenon versus other inhalation anesthetics: systematic review and meta-analysis☆

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Abstract
Study objective: To summarize and evaluate the available data describing the recovery parameters of xenon anesthesia.
Design: Systematic review and meta-analysis.
Setting: Anesthesia for elective surgeries.
Patients: Systematic review of randomized controlled trials (RCTs) from databases including Medline (1964-2013), the Cochrane Central Register of Controlled Trials (CENTRAL, 1990-2012), and Google Scholar (1966-2013).
Interventions: Inhalation of xenon or other anesthetics was administered in elective surgery.
Measurements: Recovery parameters (time to recovery, alertness/sedation scale scores at "eye opening," bispectral index at "reaction on demand," time to extubation, and time to orientation).
Main results: Eleven RCTs (N = 661 patients) met the inclusion criteria. Recovery from xenon anesthesia was significantly faster in terms of the time to eye opening (mean difference [MD], −4.18 minutes; 95% confidence interval [CI], −5.03 to −3.32 minutes; $P < .00001$), the time to reaction on demand (MD, −5.35 minutes; 95% CI, −6.59 to −4.11 minutes; $P < .00001$), the time to extubation (MD, −4.49 minutes; 95% CI, −5.40 to −3.58 minutes; $P < .00001$), and the time to orientation (MD, −4.99 minutes; 95% CI, −6.45 to −3.52 minutes; $P < .00001$).
Conclusions: This meta-analysis confirmed that recovery from xenon anesthesia is faster than other inhalation anesthesia.

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1. Introduction

An ideal anesthetic agent provides a rapid onset of effect with a short time to recovery [1]. Xenon, an inert gas, has attracted renewed interest because it possesses many of the properties of an ideal inhaled anesthetic [1–3]. It is odorless, nonpungent, nontoxic, nonexplosive, and nonflammable.

The blood-gas partition coefficient of an inhaled anesthetic indicates its onset time and recovery speed. In the late 1990s, Goto et al [4] confirmed that the blood-gas coefficient of xenon may be lower than 0.14 and closer to 0.115, the lowest of all known anesthetics. On the basis of xenon's pharmacokinetic characteristics, it may have a profile that favors rapid recovery from anesthesia. This offers a number of advantages. Results from preclinical studies indicate the inhalational anesthetics like xenon may increase neuronal apoptosis and reduce neurogenesis and therefore affect neuron development in neonatal animals. This may be of particular importance in elderly patients. Elderly patients who undergo surgery have a higher risk of experiencing postsurgery cognitive decline. The mechanism is unclear, but nonclinical models suggest that interactions between inhalational anesthetics and neurodegenerative mechanisms, similar to observed in Alzheimer disease, may be responsible for postoperative cognitive dysfunction [5]. Thus, inhalational anesthetics that have a rapid onset of action and short recovery time may be preferable in certain patient populations because these agents minimize the amount time of patients under anesthesia.

To demonstrate the recovery advantages of xenon, we performed a systematic review to quantitatively evaluate the available evidence for the recovery parameters of xenon versus other inhaled anesthetic agents.

2. Methods

This systematic review and meta-analysis was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [6]. We conducted a comprehensive literature search of MEDLINE

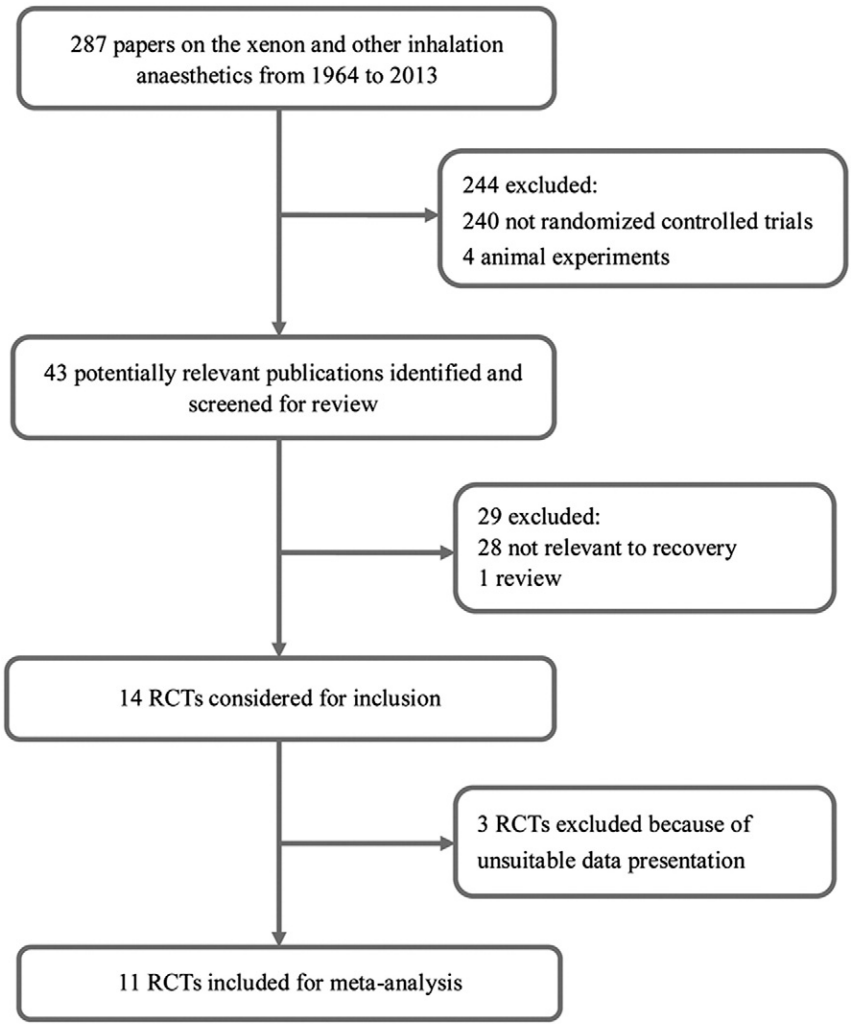

Fig. 1 Flow diagram of screening process for studies eligible for analysis.