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Selected highlights in clinical anesthesia research

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ABSTRACT

Study objective: To review research highlights of manuscripts published in 2016 that pertain to all aspects of the clinical practice of anesthesiology.
Design: Narrative review.
Setting: N/A.
Materials: The major themes address broad categories of general anesthesia including airway management, abdominal surgery, and obstetrical and gynaecological anesthesia. In addition, recent advancements in specialties of anesthesiology including regional anesthesia are reviewed.
Interventions: N/A.
Main results: N/A.
Conclusions: This recent body of evidence will both help inform anesthesiologists of the developing trends in anesthesiology and will also pose new challenges for further studies.

Contents

1. Airway management

Airway management is one of the most important skills of an anaesthesiologist, and securing an airway safely and effectively is vital to provide effective ventilation to the patients. Failed intubation and ventilation are major causes of anesthesia-associated mortality and a major cause of malpractice claims in obstetrics [1,2]. The relevance of efficient and competent decision making in managing difficult airways and the evaluation of different equipment is emphasized.

The intubation difficulty scale (IDS) instrument has been demonstrated to show a good correlation between the IDS score and the visual analogue score assessment of difficulty and time to completion of intubation [3]. In a cross-sectional study involving 552 obese patients, Siriussawakul et al. investigated the performance of the IDS among obese patients to define difficult tracheal intubation according to the anesthetic personnel [4]. The assessment included “somewhat difficult” and “difficult” endotracheal intubation with the overall performance of the IDS using the area under the receiver operating characteristic curve of somewhat difficulty intubation is 0.99 with 95% confidence interval of 0.98 and 0.99 and for difficult intubation it is 1 (95% confidence interval, 1–1). The authors concluded that a score of ≥2 is the cut-off point to indicate somewhat difficult intubation and a score of ≥5 indicates a difficult intubation in this population.

Laryngoscopy and tracheal intubation is associated with a reflex sympathetic response resulting in a transient increase in heart rate and blood pressure [5]. Selective alpha 2 agonists' dexmedetomidine and clonidine have been used to blunt the hemodynamic changes that arise during laryngoscopy and intubation. Kakkar et al. compared the

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efficacy of intravenous clonidine 1 μg/kg, and dexmedetomidine in doses of 0.5 μg/kg and 1 μg/kg on attenuating hemodynamic responses and concluded that all three active comparators attenuate the response; however, Clonidine 1 μg/kg was associated with lesser side effects [6]. Labetalol 0.25 mg/kg IV has also been demonstrated to attenuate the sympathetic response but not as effectively as dexmedetomidine [7]. Pre-treatment with 20 μg/kg nicardipine has been demonstrated to shorten the onset time of rocuronium and abate the cardiovascular responses to tracheal intubation [8]. In a prospective dose-finding study using Dixon's up-and-down sequential method, Yao et al. investigated the median effective concentration (50EC) of remifentanil during target-controlled infusion for tracheal extubation during emergence from total intravenous anesthesia in female elderly patients undergoing elective jaw cyst surgery. The heart rate and mean arterial pressure were significantly lower in patients with a smooth extubation as compared with those with failed smooth extubation at extubation ($P < 0.05$). This relationship was sustained at 1 and 5 min after extubation ($P < 0.05$). Target infusion of remifentanil at the EC 50 (0.94 ng/mL) may prevent tracheal extubation-related cough response and cardiovascular responses in 50% of elderly female patients without delaying recovery from anesthesia [9].

A properly placed endotracheal tube (ETT) is of vital importance since unrecognized esophageal intubation can prove fatal. Correct placement of an ETT has been defined as a tube tip position >2.5 cm from the carina and >3.5 cm below the vocal cords [10]. Tailleur et al. measured ETT tip displacements during head and neck movements using two standard methods of placement. With the head in the neutral position, a disparity of ETT tip distance to the carina was 5 cm (3.5–7.0) [11]. During maximal head and neck extension, cephalad tube movement was demonstrated in 68% of patients, while caudal tube displacement was present in 76%. Left and right head rotation resulted in tube displacement in 50% of patients thereby suggesting reassessment of tube positioning following head and neck movements. Poor tube placement may lead to complications during intubation [12]. Moreover, stylet removal from tracheal intubation may result in transient sore throat. Kusunoki et al. measured the extraction force during stylet removal and concluded that an extraction force of >10.3 N is associated with postoperative sore throat [13].

Tracheal extubation is an important step during emergence from general anesthesia. Acetylcholinesterase inhibitors are the mainstay treatment for the reversal of non-depolarizing neuromuscular agents, such as rocuronium. In the past decade, a new agent, sugammadex, has been investigated extensively in adults because of its effective reversal of profound induced blockade with non-depolarizing agents [14–16]. Recently, the efficacy and safety of sugammadex for reversing neuromuscular block induced by rocuronium has been reported in infants [17]. Previous trials have demonstrated that sugammadex may be associated with encapsulation of other steroidal molecules [18,19]. In a randomized controlled trial involving fifty adult males undergoing lower extremity surgery, Gunduz et al. investigated serum aldosterone, cortisol, progesterone, and free testosterone levels in patients who received either neostigmine or sugammadex perioperatively. Patients who received sugammadex did not report adverse effects of progesterone and cortisol; however, a transient increase in aldosterone and testosterone was present [20].

In a prospective randomized double-blind clinical trial, Kim et al. compared the recovery times and respiratory complications during emergence after deep extubation using either desflurane (1.5 minimum alveolar concentration) alone or a lower concentration of desflurane with remifentanil (1.0 minimum alveolar concentration; 1.0 ng/mL effect-site concentration). The time from extubation to the time when the patient could breathe without assistance was reduced in the desflurane and remifentanil group compared to the patients receiving desflurane ($P < 0.001$). Moreover, respiratory complications were also lower in the desflurane group compared to the combined desflurane and remifentanil group (48% vs 3.8%; $P < 0.001$). The authors concluded that the combined use of remifentanil with a lower concentration of desflurane improves the recovery outcome during emergence following deep extubation [21].

In a randomized controlled study of adult women undergoing laparoscopic hysterectomy, Putz et al. investigated the effect of emergence from a deep to moderate neuromuscular blockade with sugammadex or a shallow block with neostigmine on time to operating room discharge after surgery. The neostigmine group received rocuronium ($0.45\ mg \cdot kg^{-1}$), and at the end of surgery, neostigmine ($50\ \mu g \cdot kg^{-1}$) with glycopyrrolate was administered. The sugammadex group received a higher intubating rocuronium dose ($0.6\ mg \cdot kg^{-1}$) and sugammadex ($2–4\ mg \cdot kg^{-1}$) to reverse the block at the end of surgery. All patients were extubated after obtaining a train-of-four ratio of 0.9. Patients that received sugammadex experienced a faster time to operating room discharge compared to patients in the neostigmine group (9.15 ± 4.28 min vs 13.87 ± 11.43 min respectively; $P = 0.005$). There was no difference in time spent in the postanesthesia care unit between groups.

Improvement in clinical and resident protocols have lowered the risk associated with unexpected difficult airway situations, however, planning for difficult airways is still a priority in clinical practice [22]. Udeh et al. determined the number of difficult airway carts required based on the number of anesthetising locations, assuming an average risk of 10%. The probability of encountering concurrent difficult airways increases as the number of simultaneously started anesthetising locations increases. The authors concluded that one difficult airway cart should be assigned for every 15 to 20 anesthetising locations [23].

In the last decade, there has been an increase in published clinical trials that report the time needed to successful intubation during procedures with single and double lumen tubes [24]. The placement of a double lumen tube compared to a single lumen tube may be more challenging in certain patients because of its larger diameter and may also be associated with more frequent airway trauma and bleeding [25]. In a prospective randomized trial, Kido et al. investigated double lumen tracheal extubation force (N) when two different extraction angles were used: 60° and 90° relative to the ground. Less extraction force was needed at 60° compared to 90° (90°, 13.9 ± 2.3 N; 60°; 7.1 ± 2.1 N; $P < 0.001$). The rate of increase in systolic and diastolic blood pressure (pre-extubation/post-extubation/) was significantly smaller at 60° compared to 90° (systolic blood pressure, $P < 0.001$; diastolic blood pressure, $P = 0.002$). The authors concluded that double lumen tube extubation at 60° relative to the ground may be less invasive and beneficial for patients undergoing double lumen tube extubation [26].

Maintenance of the patient's airway is an integral part of general anesthesia, and the lack of adequate ventilation is a common cause of morbidity and mortality attributable to anesthesia [27]. Providing adequate ventilation is the responsibility of an anaesthesiologist. Airway management devices on the market today can be categorized into either supraglottic or infraglottic airway devices with supraglottic devices becoming more popular due to reduction of gastric and nasal secretions. The laryngeal mask airway (LMA) is the most popular airway device in clinical practice, accounting for 30% to 60% of all general anesthesia cases [28]. In a prospective randomized controlled trial, Zhao et al. compared the insertion of the classic LMA device using either the Discopo visual stylet-guided instrument (GLMA) or the conventional blind technique (BLMA). Less time was required establish an adequate airway in patients who received the GLMA compared to the BLMA (54.8 vs 62.9 s; $P = 0.001$). Insertion during the first attempt was more frequently successful in the GLMA group compared to the BLMA group (100% vs 92%; $P = 0.041$). Patients who underwent BLMA insertion required more readjustments and reinsertions (38%, 0%). The authors found no differences between groups in relation to the hemodynamic stress response or postoperative airway morbidity. Moreover, lightwand-guided LMA has been shown to provide better success with first attempts at insertion and less damage to oropharyngeal or esophagus tissues compared to standard index finger-guided LMA insertion

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