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Welcome to issue nine of Anaesthesia Research Review.

It is my pleasure to provide you a selection of recent highlights in research in anaesthesia. Two articles focus on haemoglobin levels in patients undergoing major non-cardiac surgery: a) the influence of anaemia and red blood cell transfusion on mortality in high cardiac risk patients; and b) preoperative haemoglobin levels and iron status in patients. Another two articles explored improvements in oxygenation: a) The STRIVE Hi trial, spontaneous respiration using intravenous anaesthesia and high-flow nasal oxygen during management of the obstructed airway; and b) The Buccal RAE Tube Oxygenation trial focusing on apnoeic oxygenation during prolonged laryngoscopy in obese patients. Furthermore, a prospective cohort study of awake fibreoptic intubation practice at a tertiary centre; the results of a comparative study in inexperienced practitioners and their first-pass intubation success in ICU patients; and pain assessment in intensive care in 45 ICUs in the UK. Another study compared the results of a brachial plexus block performed before or at the end of surgery. A US group of Board Certified anaesthetists evaluated whether manikin-based simulation can reliably characterise standardised, high-fidelity simulated medical crisis scenarios.

As usual, a selection of interesting research, with the aim to stimulate your reading hunger, and information that might be useful in your practice.

Kind Regards,

Professor André van Zundert
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Simulation-based assessment of the management of critical events by board-certified anaesthesiologists

Authors: Weinger MB et al.

Summary: This study examined whether mannequin-based simulation reliably characterises management of standardised, high fidelity simulated medical crisis scenarios by board-certified anaesthetists (n = 263). Four scenarios were tested: a) laparoscopic surgery with retroperitoneal haemorrhage; b) sedation for gynaecological procedure with local anaesthetic toxicity; c) endoscopic retrograde cholangiopancreatography with postoperative malignant hyperthermia; and d) small-bowel obstruction with unstable atrial fibrillation followed by a myocardial infarction. Critical performance elements and holistic rating of technical and non-technical skills were judged by a blinded independent panel of expert anaesthetists. Across 284 simulated emergencies, board-certified anaesthetists were rated as successfully completing 81% of the critical performance elements and scored a median 5 out of 9 for holistic performance. Approximately 25% of participants received low holistic ratings. Higher-rated performances were associated with younger age. This assessment identified performance gaps and demonstrated a need for continuous improvement through medical education.

Comment: (Prof. André van Zundert) Weinger et al. showed that, in a simulation-based assessment, a substantial proportion of experienced anaesthetists struggle with managing a number of standardised medical emergencies in anaesthesia. In 70% of encounters, testing four essential skills scenarios, participants were rated as having performed at a level of a certified anaesthetist. However, 30% of encounters were scored “poor” or “unsatisfactory” for overall individual technical management of medical emergencies, i.e., correct diagnosis and therapy. Behavioural performance (i.e., decision-making, vigilance, communication and teamwork) was scored with a median rating of five out of nine points. In 46% of encounters at least four critical performance elements were missed, showing significant performance gaps. Arrival of the second anaesthetist most often improved performance ratings. Only 63% of participants had previous simulation experience. Overall, anaesthetists and trainees confirm that the use of patient simulators played an important role in their critical incident training. This study highlights that current training in anaesthesia can be improved. Curricula should not only concentrate on theory and exams but also in addition focus on providing simulation opportunities on a variety of relevant topics in anaesthesia with hands-on workshops and feedback to the candidate. These simulations can also be used to test, and (re)certify anaesthetists at different intervals in their career.

Reference: Anesthesiology 2017;127(3):475-89

Abstract
A prospective cohort study of awake fibreoptic intubation practice at a tertiary centre

Authors: El-Boghdadly K et al.

Summary/Comment: (Dr James Forbes) Awake fibreoptic intubation (AFOI) has been used since its first documented practice in 1967 for the management of difficult intubation. Much of the literature on AFOI relies on subjective survey or retrospective data. The purpose of this study was to describe current practice, quantify complications and summarise outcome data. The data from 600 AFOIs was collected over a 3-year period at a tertiary institution in the UK in a prospective observational study. They included all adult patients >18 years of age presenting for a variety of surgeries at a single centre. Overall incidence of AFOI was 1.71% in patients presenting for surgery requiring a general anaesthetic, median age was 60 years and BMI was 24.6 km/m². ENT surgery accounted for 86.2% of patients, urology for 3.8%, and orthopaedics for 3.5%. The most common indication was mouth opening <3.5cm (26.8%), followed by 22.5% for previous airway surgery, 22.5% for head and neck radiotherapy and the remaining 11.5% for limited neck extension. 86% of operators provided sedation with a combination of remifentanil and propofol target-controlled infusions. Oxygenation was provided by high-flow nasal prongs (HFNP) in 49%. When considering complications, there was no difference between HFNP or other oxygenation strategies, although usage of HFNP increased to 100% towards the end of the study. Most operators had performed AFOI >20 times previously, but trainees were the primary operator in 78.6% of cases, with 86.6% directly supervised by a consultant. The failure rate was 1%, and 11% of AFOI were complicated, mostly by multiple attempts (4.2%), over sedation (2.2%) or desaturation (1.5%). The only significant association with complications was the number of previous AFOI performed, with fewer complications occurring with more experienced operators. This was a large prospective study performed in a single centre; generalisability must be treated with caution. Some of the data from AFOIs was not collected, incomplete and therefore excluded, potentially skewing the data set. Details of loss to follow-up were not included in the study. However, this study demonstrated that awake fibreoptic intubation is a safe technique and institutional training can both develop and maintain trainee competence.

Reference: Anaesthesia 2017;72(6):694-703

Abstract

Accuracy, intra- and inter-rater reliability of three scoring systems for the glottic view at videolaryngoscopy

Authors: O’Loughlin EJ et al.

Summary/Comment: (Lucas Edwards) Videolaryngoscopy has revolutionised airway management in anaesthesia, but given its use is largely in the setting of difficult airways, accurate and reproducible recordings of the views obtained are paramount. This study compares three scoring systems: Cormack and Lehane, percentage of glottic opening (POGO) and the Fremantle Score. 30 anonymised videos of tracheal intubation with the C-MAC® video laryngoscope were recorded over a 3-month period at Fremantle Hospital. These were shown to 74 critical care doctors, who were asked to rate each according to the three scoring systems. Prior to watching the videos all participants were educated on each scoring system. There was no collaboration or discussion between raters. Most participants were anaesthetists (78%), with the remainder being emergency physicians. Accuracy (degree of agreement of score with an expert panel assessment) was highest for POGO (75.5%) and Fremantle score (73.9%), with a lower score for Cormack and Lehane (65.4%). Intra- and inter-rater reliability was also lower for Cormack and Lehane compared to POGO and Fremantle scores. The Fremantle scoring system incorporates the view obtained, ease of intubation and equipment used, providing sufficient and concise information for subsequent intubation attempts. POGO is also a useful and informative tool, but lacks an assessment of ease of intubation. Cormack and Lehane was the worst performing of the tools in this study. The practicality of any scoring system requires education, familiarity and reproducibility as well as accuracy to enable its repeated use.

Reference: Anaesthesia 2017;72(7):835-39

Abstract
The Pain Assessment in INTensive care (PAINT) study was a behavioural pain assessment tool.

During the 24-hour study period, 64.5% of patients were not documented to have received any pain assessment.

While the results of this study are promising, the small sample size makes it difficult to make meaningful recommendations. However, the utilisation of readily available and inexpensive equipment in most anaesthetic departments increases the appeal of this technique. The nasal delivery of oxygen may be contraindicated in trauma or coagulopathic patients, further increasing the utility of this method.

Limitations of this study aside from sample size include optimal flow rates for pharyngeal pressure and carbon dioxide clearance. Further research in larger trials, comparison with other available techniques (i.e., high flow nasal cannule) and other patient groups such as the morbidly obese or pregnant patients may alter clinical practice. The portability of this technique may extend its usefulness in the PACU, off theatre sites or in the transport of patients between theatre, intensive care and the PACU.


Pain Assessment in INtensive care (PAINT): an observational study of physician-documented pain assessment in 45 intensive care units in the United Kingdom

Authors: Kemp Hl et al.

Summary: The Pain Assessment in INtensive care (PAINT) study was a 24-hour observational service evaluation across 45 adult ICUs in England that evaluated physician (n = 362) assessments of pain from 750 patients according to published guidelines. During the 24-hour study period, 64.5% of patients (95% CI 60.9-67.8%) received no physician-documented pain assessment; 28.6% (95% CI 25.5-32.0%) received no nursing-documented pain assessment, and 21.2% (95% CI 19.2-23.4) received neither. Only two ICUs used a validated behavioural pain assessment tool.

Comment: (Karla Pungsornruk) This study demonstrates that pain assessment is underutilised in the intensive care environment. Considerable potential exists to improve pain assessment with theoretical benefit to both comfort and outcome. The observational nature of the study, based on documented pain assessments, limited the findings, but highlights urgent need for further work in this area. The delivery of this large-scale project via an anaesthetic trainee research network demonstrates the feasibility of the trainee-led research network model in anaesthesia.

Reference: Anaesthesia 2017;72(8):967-77

Pre-operative brachial plexus block compared with an identical block performed at the end of surgery: a prospective, double-blind, randomised clinical trial

Authors: Holmberg A et al.

Summary: This study in 52 patients undergoing fractured radius fixation under remifentanil and propofol anaesthesia compared preoperative versus postoperative ultrasound-guided infraclavicular brachial plexus block (0.5 ml/kg ropivacaine 0.75%) for postoperative analgesia. Mean time to first rescue analgesic (opioids for breakthrough pain) was 544 versus 343 minutes (p = 0.015) after emergence from general anaesthesia in preoperative versus postoperative block recipients. Higher postoperative pain scores and more patients requiring rescue analgesia during the first 4 hours were observed in postoperative block recipients. Analgesic consumption was lower after 7 days in the preoperative block recipients.

Comment: (Charles Williams) Clinical question: Whether performing an infraclavicular brachial plexus block before or after an ORIF of a fractured radius resulted in better postoperative analgesia. Population: 52 ASA 1 or 2 patients with radius fractures requiring volar plate under general anaesthesia. Exclusions were extremes of BMI, pregnancy, chronic pain and contraindications to proposed management. General Anaesthesia: All received propofol/remifentanil general anaesthesia and a laryngeal mask airway. Regional: The doctor performing the block opened a randomisation envelope before induction. The preoperative block group had an infraclavicular block performed after induction, 20 minutes before surgery. Patients in the postoperative block group had the same block performed just after the end of the procedure and were kept anaesthetised for another 20 minutes. Postoperative: All patients were recovered by blinded nurses, with the same pain protocol. On discharge to the ward, three BD doses of 20 mg oxycodone CR plus paracetamol were prescribed, plus rescue analgesia. Results: Primary – time to first rescue analgesia was longer in the preoperative block group – 544 vs 343 minutes. Secondary – pain described as “very strong” when the block wore off in 27 of 52 patients. Due to the small number of patients there were no significant differences between pain or functional problems between the groups at 6-months’ follow up. Discussion – This study suggests beneficial effects on pain from pre-emptive regional analgesia, which we have suspected to previously be due to avoiding “pain wind up” and sensitisation. Results such as these might be applicable to a wide range of surgeries and regional blocks, and suggest that when practical, regional anaesthesia should be performed preoperatively.

Reference: Anaesthesia 2017;72(8):967-77
Pre-operative haemoglobin levels and iron status in a large multicentre cohort of patients undergoing major elective surgery

Authors: Muñoz M et al.

Summary: Preoperative anaemia is known to be associated with poor outcomes in patients, with increased postoperative infection rates, length of stay and mortality being associated with the condition. Iron deficiency anaemia is the commonest cause of anaemia worldwide, but non-anaemic iron deficiency is slowly being recognised as a disease entity in its own right. This study was a retrospective analysis of a large cohort of consecutive patients undergoing major elective procedures in five centres in Spain, in an effort to determine the prevalence of preoperative anaemia. A definition of anaemia was given as a haemoglobin (Hb) level <130 g/L for both sexes, and iron deficiency as a serum ferritin level <30 ng/mL (unless there was inflammation [CRP >5 mg/L] or transferrin saturation <20%, in which case ferritin <100 ng/mL was used instead). In the study, 33/42 patients’ data were analysed, and 12/12 (30%) were identified as anaemic. The highest prevalence of anaemia was found in patients undergoing colorectal cancer resection and gynaecological surgery (both 64%). The lowest prevalence of anaemia was found in patients undergoing radical prostatectomy (8%). In the 1898 non-anaemic patients, 33% were found to be iron deficient, 9% had iron sequestration and 27% had low iron stores. In comparison, to the anaemic patients, 62% had absolute iron deficiency, 10% had iron sequestration and 15% had low iron stores. In both groups of patients, iron deficiency was more prevalent in patients undergoing colorectal cancer resection and gynaecological surgery.

Comment: (Anthony Baird) Preoperative anaemia is present in a large proportion of patients who present for elective surgery, and even patients who are not anaemic may have low iron stores, which can lead to inadequate recovery from postoperative anaemia. However, studies have shown that identifying iron deficiency anaemia prior to major elective surgery, and treating it appropriately, can lead to reduced transfusion requirements and improved outcomes. By identifying the prevalence of preoperative anaemia, this study is able to identify the scope of the problem, so that appropriate resources may be allocated to diagnosing and treating the condition in patients preoperatively. Also, this study has shown that a large percentage of patients are not anaemic, but have low iron stores and may therefore be at risk of postoperative anaemia and blood transfusion, and may consequently benefit from iron replacement as well. The study appears to be robustly designed with a large number of patients included, which is enough to identify the prevalence of a common condition in the preoperative cohort of patients. However, the trial is limited somewhat by not linking the prevalence of preoperative anaemia and iron deficiency with morbidity and mortality outcomes, particularly need for transfusion, hospital length of stay, and mortality. It also does not make any comment on any preoperative optimisation that patients may have received once their anaemia was identified. However, the data that has been gathered in this trial may be useful justification for designing further trials that determine morbidity and mortality associated with the conditions, as well as looking at management options for preoperative anaemia and iron deficiency. Ultimately, the take home message of this study is that preoperative anaemia and iron deficiency are common conditions affecting patients undergoing a number of major elective procedures, and there is scope for further studies looking at management of these conditions.

Reference: Anaesthesia 2017;72(7):826-34
Abstract

Influence of anaemia and red blood cell transfusion on mortality in high cardiac risk patients undergoing major non-cardiac surgery: a retrospective cohort study

Authors: Feng S et al.

Summary/Comment: (Angela Tognolini) Anaemia is common in the perioperative period, and has an increased prevalence in patients with cardiac disease. Whilst anaemia is associated with increased postoperative morbidity and mortality, RBC transfusion also carries its own associated complications, thus there is a need for balance between risk and benefit to optimise outcome. Over the years there has been a move from a liberal to more restrictive blood transfusion strategy. This retrospective single-centred Canadian cohort study was conducted on 375,000 major non-cardiac surgical patients over a 13-year period (2003 to 2015) to assess the association of postoperative anaemia, RBC transfusion, and cardiac risk with 30-day inhospital mortality. The prevalence of postoperative anaemia was 63% overall and 80% in the high cardiac risk population, with 30% having a Hb concentration of 80 g/L. Patients with high cardiac risk were also more likely to receive RBC transfusions, up to double that of patients with low cardiac risk. RBC transfusion was also associated with increased mortality. However, in patients with high cardiac risk and a postoperative Hb of <80 g/L, RBC transfusion has a protective effect with decreased mortality (OR 0.37; 98.4% CI 0.17-0.77). Unfortunately this study was underpowered to determine mortality in patients with a postoperative Hb of <70 g/L, as given the low number of patients in this subgroup, they were included in the <80 g/L patient group. The only outcome considered in this analysis was mortality. Morbidity, including acute coronary syndrome, myocardial infarction, pulmonary oedema, and acute kidney injury, was not assessed. In addition, the decision to transfuse, the use of preoperative iron replacement, and improved outcomes. By identifying the prevalence of preoperative anaemia, this study is able to identify the scope of the problem, so that appropriate resources may be allocated to diagnosing and treating the condition in patients preoperatively. Also, this study has shown that a large percentage of patients are not anaemic, but have low iron stores and may therefore be at risk of postoperative anaemia and blood transfusion, and may consequently benefit from iron replacement as well. The study appears to be robustly designed with a large number of patients included, which is enough to identify the prevalence of a common condition in the preoperative cohort of patients. However, the trial is limited somewhat by not linking the prevalence of preoperative anaemia and iron deficiency with morbidity and mortality outcomes, particularly need for transfusion, hospital length of stay, and mortality. It also does not make any comment on any preoperative optimisation that patients may have received once their anaemia was identified. However, the data that has been gathered in this trial may be useful justification for designing further trials that determine morbidity and mortality associated with the conditions, as well as looking at management options for preoperative anaemia and iron deficiency. Ultimately, the take home message of this study is that preoperative anaemia and iron deficiency are common conditions affecting patients undergoing a number of major elective procedures, and there is scope for further studies looking at management of these conditions.

Abstract

Video laryngoscopy vs direct laryngoscopy on successful first-pass orotracheal intubation among ICU patients

Authors: Lascarrou JB et al.

Summary: This study (The McGrath Mac videolaryngoscope versus Macintosh laryngoscope for orotracheal intubation in the Critical Care Unit [MACMAN]) compared video laryngoscopy (VL; n = 185) versus direct laryngoscopy (DL; n = 186) for first-pass orotracheal intubation in ICU patients. Successful first-pass intubation rates did not differ between the VL and DL groups (67.7% vs 70.3%; absolute difference, -2.5%; 95% CI -11.9 to 6.9). First-attempt intubations by non-experts, primarily residents (n = 290) also did not differ between groups (84.4% vs 83.2%; absolute difference 1.2%; 95% CI -6.3 to 8.6). Median time to intubation was 3 minutes in both groups. Life-threatening complication rates also did not differ between groups (13.5% vs 9.5%; absolute difference, 3.8%; 95% CI -2.7 to 10.4). Post hoc analysis suggested that VL was associated with more severe life-threatening complications (9.5% vs 2.8%; absolute difference 6.7%; 95% CI 1.8 to 11.6; p = 0.01) but not mild-to-moderate life-threatening complications (5.4% vs 7.7%; absolute difference -2.3%; 95% CI -7.4 to 2.8).

Comment: (Louven Menzies) Overview: MACMAN was a non-blinded multi-centre RCT conducted in seven French ICUs. It randomised patients into two groups: DL, which used an appropriately sized Macintosh blade; and VL, which used a McGrath video laryngoscope. MACMAN aimed to see if the incidence of first-pass tracheal intubation was greater with the VL group when compared to the DL group. All patients requiring intubation in the ICU during the data collection period were included, and randomised to either VL or DL, and then further stratified by intubator skill level into four subgroups; expert VL, non-expert VL, expert DL, and non-expert DL. Exclusion criteria were contraindications to ICU orotracheal intubation (e.g., C-spine instability), patients younger than 18 years of age, prisoners or those deemed incompetent to withstand consent, and previous inclusion in this or other trials with intubation as an endpoint. Discussion: MACMAN found no statistically significant difference in first-pass success between VL and DL. The secondary outcomes included increased incidence of “good view” of glottic opening with no change in first-pass success, increased use of a gum elastic bougie in VL, and interestingly, a statistically significant increase in life-threatening complications (severe hypoxaemia, cardiovascular collapse, cardiac arrest, and death) in the VL group. There are many limitations to this trial that prevent it from being applied to Australian ICUs, including differences in demographics, and the types of video laryngoscopes commonly used.

Reference: JAMA. 2017;317(5):483-93
Abstract

Reference: Anaesthesia 2017;72(7):826-34
Abstract

Abstract

Reference: JAMA. 2017;317(5):483-93
Abstract

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SponTaneous Respiration using IntraVEnous anaesthesia and Hi-flow nasal oxygen (STRIVE Hi) maintains oxygenation and airway patency during management of the obstructed airway: an observational study

Authors: Booth AWG et al.

Summary: This retrospective observational study utilised a SponTaneous Respiration using IntraVEnous anaesthesia and High-flow nasal oxygen (STRIVE Hi) anaesthetic technique in 30 adult patients undergoing elective laryngotraechal surgery. 26 patients (87%) presented with significant airway and/or respiratory compromise, however, airway patency was maintained during induction of general anaesthesia with STRIVE Hi, with no episodes of apnoea or complete airway obstruction. Oxygen saturations were preserved, with a median lowest oxygen saturation during induction of 100%. During maintenance, no oxygen desaturation <90% was observed while the FiO2 was 1.0, whilst three patients experienced controlled oxygen desaturation when FiO2 was decreased to 0.3 to facilitate safe laser surgery. The median overall duration of spontaneous ventilation was 44 minutes, during which ETCO2 levels remained within acceptable limits. The median ETCO2 at the end of the spontaneous ventilation period was 51 mmHg, with a mean rate of increase in ETCO2 of 0.23 mmHg/min. The median BMI of the patient cohort was 29 kg/m2.

Comment: (Jennifer Bath) Whilst high-flow nasal oxygen (HFNO) has been utilised in a range of clinical scenarios, this is the first study to describe its use in spontaneously breathing patients undergoing general anaesthesia. The aim of the STRIVE induction, whereby spontaneous ventilation is maintained throughout the entire induction period using an upwardly titrated infusion rate of propofol, is to maintain oxygenation by preventing apnoea and complete airway obstruction, while simultaneously achieving an adequate depth of anaesthesia to tolerate airway instrumentation. In this study, use of STRIVE Hi allowed several high-risk patients with co-existing airway and respiratory compromise to be anaesthetised for (predominantly) tubecless microlaryngoscopic surgery, without significant detriment to their respiratory function. Moreover, in comparison to the apnoeic technique utilised in THRIVE (Transnasal Humidified Rapid-Insufflation Ventilatory Exchange), the control of CO2 may suit particular patient subgroups intolerant of hypercapnia, with preservation of ventilation at deep levels of anaesthesia in a time-independent manner. The versatility of STRIVE was shown by utility in both severe airway obstruction and difficult laryngoscopy, with maintenance of oxygenation over prolonged periods of anaesthesia in the obese. The ability to laser in 30% HFNO is another real benefit, with the combination of HFNO and spontaneous respiration yielding rapid re-oxygenation when FiO2 was subsequently increased. The authors propose that the positive airway pressure generated by HFNO counteracts a tendency to collapse, improves airway patency and reduces risk of airway compromise, thus increasing the margin of safety during airway manipulation. Thus whilst this small, single site study is limited by its retrospective and observational nature, the results support use of STRIVE Hi as a modern alternative to traditional inhalation induction or jet ventilation, and a valuable management approach to the difficult or obstructed airway.


Abstract

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