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Correspondence

Etomidate and injection pain in children

Editor—We read with interest the study by Nyman and colleagues[1] concerning etomidate and injection pain in children. It is well accepted that a single bolus dose of etomidate can result in adrenal suppression in adult patients, not only the critically ill[2] but also in healthy young adults.[3] Single bolus dose etomidate has also been linked with impaired adrenal function in critically ill children, leading to increased mortality.[4] Although we are not aware of a study demonstrating impaired adrenal function in healthy children after a single dose of etomidate, it seems reasonable to assume that the immature adrenal would be at least as sensitive to etomidate, if not more so, than the mature adrenal.

Nyman and colleagues should be commended for attempting to find a solution to i.v. injection pain in children, but it is surely unwise to suggest widespread use of an agent with such a serious side-effect to solve the relatively minor problem of injection pain. We are concerned that increased use of etomidate in healthy children could reveal a clinically significant impairment of adrenocortical function. We suggest further research into a less irritant preparation of propofol would be the safer way to proceed.

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Editor—We read with interest the comments from Drs Slater and Gupta in regards to our recent publication showing significantly less injection pain by the new lipid formulation of etomidate as compared with propofol with lidocaine in children. As is evident from our discussion section, we are well aware of the potential of etomidate to cause a transient alteration of adrenocortical function after a single induction injection of etomidate, but there is to our knowledge no evidence to suggest that this limited action on the adrenal cortex can cause any harm to otherwise healthy children. Although no data are currently available, we believe that it is reasonable to assume that a similar suppression of adrenocortical function will result from the widespread use of quite high-doses of dexamethasone for PONV prophylaxis, a practice that most anaesthetists regard as perfectly safe.

We now routinely use etomidate for anaesthesia induction in healthy paediatric outpatients (ASA I–II) but will not use it for total i.v. anaesthesia, prolonged sedation, frequent anaesthesia (e.g. burn dressing changes) or use in ASA III–IV patients due to the potential problem of more prolonged/pronounced adrenocortical suppression. Thus, we do not recommend uncritical use of etomidate in all paediatric patients that will have an i.v. induction of anaesthesia.

Finally, one can choose to look at this complex problem as follows: prolonged infusions of propofol in children can cause the life-threatening propofol infusion syndrome and prolonged infusions of etomidate can cause life-threatening adrenocortical suppression. However, there is currently no evidence that a single induction dose of either propofol or etomidate will cause any harm to otherwise healthy children. Thus, if one of the drugs causes significant injection pain and the other does not, why should we use the drug that hurts?

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Predicting fluid responsiveness in theatre

Editor—I read with interest the article by Solus-Biguenet and colleagues[1] which demonstrated clearly the ability of dynamic tests of the circulation to predict fluid responsiveness intraoperatively. They are the first group to do so with a non-invasive dynamic test, namely respiratory variations in non-invasive pulse pressure but they have not discussed the value of systolic pressure variation (SPV) with respiration and I think this is an omission.

In 2003, Tavernier and colleagues[2] found that the delta down component of SPV could guide fluid therapy during phaechromocytoma surgery, illustrating its ability to clarify the mechanism of hypotension after tumour removal and showing the value of dynamic tests during haemodynamic instability in theatre. When patients have reached the flat part of their Starling curve, they no longer respond to fluids by increasing cardiac output and require other treatments if increased cardiac output is desired. This can be identified rapidly in mechanically ventilated patients by demonstrating minimal SPV and this was clear in Tavernier's report. The ability of dynamic tests to identify the point at which resuscitation with fluids should stop and be followed by resuscitation with inotropes is a clinically invaluable feature not possessed by other measurement techniques.

Other features make SPV the most valuable dynamic test of the circulation. It employs widely available equipment which can be calibrated easily by users using the fast-flush technique to ensure optimal damping.[3] Repeated assessments of SPV can be made in theatre or at the bedside by labelling arterial pressure as pulmonary artery pressure and then using the wedge pressure function of the monitor. This has the effect of displaying two mechanical breaths on the screen accompanied by a simultaneous arterial pressure trace. SPV can be easily seen and quantified if desired using a cursor. This technique was described by Tavernier and amplified recently by Gouvea.[4] An additional refinement is that pausing mechanical ventilation allows end-expiratory systolic pressure to be measured and delta down calculated. It is not currently possible to measure pulse pressure variation in real time in theatre; perhaps, software updates will change this.

Another benefit of SPV is that it does not depend on manufacturers' algorithms or their choice of measurement periods. The latter has rendered stroke volume variation by pulse contour analysis slightly less precise than pulse pressure or systolic pressure variation as a predictor of fluid responsiveness.[5]

Insertion of an arterial cannula under local anaesthesia (LA) before induction of general anaesthesia allows the circulatory changes of induction to be observed and treated. SPV subsequently serves as a good predictor of fluid responsiveness, even if there is haemodynamic instability, and can identify when patients with impaired ventricular function have reached the flat part of their Starling curve. The future may lie with observation of non-invasive pulse pressure variation but for the moment arterial cannulation under LA remains the core skill for anaesthetists managing the circulation of mechanically ventilated patients.

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Editor—We thank Dr Runcie for his interest in our article[1] and for his additional comments, which put forward the value of the arterial SPV and its expiratory component (delta down) in assessing fluid responsiveness and regrets that these indices were not measured in our patients. In fact, the main aim of our study was to assess the value of various non-invasive variables for predicting fluid responsiveness in the operating theatre. This evaluation necessitated the selection of a 'gold standard' measure and, from the currently available literature, the arterial pulse pressure variation (PPV) is the best candidate. The pulse pressure is directly proportional to stroke volume and inversely related to arterial compliance. Therefore, the respiratory variation in left ventricular stroke volume is the main determinant of PPV. In contrast, because the systolic pressure depends on both pulse and diastolic pressures, SPV also depends on changes in extramural aortic pressure, that is, changes in pleural pressure.[6] Accordingly, several studies have found that PPV predicted haemodynamic response to fluid expansion slightly but significantly better than SPV and delta down,[5 7] and PPV correlated more closely with the increase in stroke volume resulting from fluid infusion than both SPV and delta down.[8] A recent study analysed the correlation and agreement between PPV, SPV, and delta down and their corresponding photoplethysmographic indices (expressed in %).[9] Cardiac output was not measured, and thus fluid responsiveness was not directly assessed. The study, however, suggested that pulse variation was the only photoplethysmographic indice that may identify patients likely to respond to fluid administration (as assessed from arterial PPV and delta down values).

We agree with Dr Runcie that, when using the 'wedge pressure' menu of the monitor for quantification of respiratory changes in arterial pressure, as previously proposed by us[2] and others,[4] SPV and delta down are obtained more easily and rapidly than PPV. The latter, however, can be measured and calculated in 1–2 min using this procedure, and this is now routinely done by many anaesthetists at our institution. Dr Runcie also claims that a benefit of SPV is that it does not depend on manufacturers' algorithm or their choice of measurement periods. Stroke volume variation by pulse contour analysis was indeed shown less precise than PPV or SPV as a predictor of fluid responsiveness.[5] However, this result may depend only on a lack of accuracy for assessment of rapid changes (over a single breath) in stroke volume from the arterial pressure contour, and thus not concern automated calculation of PPV. Moreover, from a strictly evidence-based point of view, the value of PPV, SPV, and delta down as predictors of fluid responsiveness has been established from off-line measurements on computer recordings, not from the 'frozen' arterial trace on the monitor screen. We believe that dynamic indices will be widely used by clinicians only when monitors allow automatic calculation and real

monitoring. These evolutions should be effective in most monitors in the near future.

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Tracheal intubation of morbidly obese patients

Editor—I read with great interest the paper by Dhonneur and colleagues[1] on tracheal intubation of morbidly obese patients: LMA CTrach™ *vs* direct laryngoscopy (DL). It was very impressive that they were not only successful in tracheal intubation of all patients using LMA CTrach™ (CT), but also were able to view the advancing tracheal tube through the glottis. In the DL group 17% of patients with Cormack and Lehane grade 3 required a gum elastic bougie to assist tracheal intubation, resulting in total and partial blind intubations. The down side being the average duration of tracheal intubation being 119 s in DL group and 176 s in CT group. Previous papers[2 3] using CT showed 100% success rate in ventilation of patients and a 96% success rate in tracheal intubation either blindly or viewing the tracheal tube passing through the vocal cords.

Table 1 Training in the management of different airway systems

Level of training	Total number	Number of trainees who received formal training in the management of airway devices					
		LMA	Flexible LMA	Proseal LMA	ILMA	LMA CTrach	FOI
SHO							
Year 1	2	2	2	2	1	1	1
Year 2	4	4	3	3	3	3	3
Year 3	4	4	4	4	4	1	1
SpR							
Year 2	4	4	4	4	4	0	4
Year 3	5	5	5	5	4	0	5
Year 4	1	1	1	1	1	0	1
%		100	95	95	85	25	75

In a study by Baskett and colleagues[4] involving ILMA, a multicentre trial with 500 patients showed a success rate of 90% in tracheal intubation. In all these trials, most of the failures in tracheal intubation using CT and ILMA happened in the first 20 attempts of inserting the airway device by the anaesthetist as per the manufacturer's recommendations. This clearly indicates that the more experience one has the more likely is the success.

My concern is the level of competency achieved by trainees in anaesthesia in handling these airway devices. I recently conducted a survey among 20 trainees at different levels of training regarding the level of competency achieved by trainees in different airway devices (Table 1). This survey was conducted at the Royal Berkshire Hospital, Reading, which has been the pioneer and a leading force in the invention and use of airway devices like Classic LMA™, ILMA, and CT. Most of the trainees replied that though they were trained for the use of the devices, they were not confident of using ILMA, fibre-optic intubation (FOI) and CT in an emergency situation. They expressed a need for more training in these devices; 16 trainees did not receive any formal training in LMA CTrach, 14 felt a need for more training in the use of FOI technique, and 8 felt though they were trained in ILMA and fibre-optic system they were not confident using it independently and in an emergency situation.

The survey group was small and there is a need for a larger study regionally and nationally. It is difficult to deny the fact that there is a necessity for more training in the use of the above-mentioned airway devices.

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