Elevation of $P_{ET}CO_2$ after submucosal epinephrine

To the Editor:
A 14-yr-old boy with chronic sinusitis presented for a Caldwell-Luc procedure, ethmoidectomy, and antrostomy. Induction of anaesthesia was accomplished with thiopentone and pancuronium followed by uneventful tracheal intubation and was maintained with isoflurane 0.75%, nitrous oxide 60%, and fentanyl. The surgeon injected 6 ml lidocaine (1%) with 1:100,000 epinephrine submucosally. Approximately 20 sec later $P_{ET}CO_2$ increased from 32 to 40 mmHg and remained elevated for three minutes. The continuous CO_2 wave form analysis was measured by infrared spectrometry and verified with mass spectrometry every two minutes. Minute ventilation had remained constant. Increases in heart rate, blood pressure (130/60 to 170/90 mmHg), and oesophageal temperature (36.1° to 36.4°) accompanied the CO_2 elevation. After three minutes the $P_{ET}CO_2$ returned to 32 mmHg without any changes in ventilation. Similar changes followed two subsequent injections of 1% lidocaine with epinephrine.

Barber[1] studied the haemodynamic and plasma catecholamine response to perianal injection of lidocaine 0.5% with 1:200,000 epinephrine and noted a rise in serum epinephrine levels without appreciable changes in heart rate or blood pressure. Chernow[2] observed similar results in dental patients given 1.8 ml lidocaine 2% with 1:100,000 epinephrine. Increases in serum epinephrine levels occured without changes in blood pressure or heart rate. In our case, the increase of blood pressure and heart rate following submucosal injection of lidocaine and epinephrine may have been due to injection into inflamed, vascular sinuses where rapid vascular absorption occurred in close proximity to the heart.

Epinephrine may increase exhaled CO_2 through several mechanisms. Bronchodilation could increase alveolar dead space thereby reducing effective ventilation; increased cardiac output may increase CO_2 returned to the lungs without changing metabolic rate; peripheral vasoconstriction might increase central blood volume and pulmonary blood flow; lung zone characteristics may be altered to convert Zone 1 to Zone 2 or 3 with a decrease in dead space and an increase in exhaled CO_2; and epinephrine may increase metabolic rate.

We observed an increase in $P_{ET}CO_2$ after submucosal injection of epinephrine. We feel this was related to the rapid systemic absorption of epinephrine from the site of injection. The patient suffered no ill effects. Nevertheless, close attention should be given to the concentration, volume, and location when using epinephrine-containing solutions. Since submitting this report, we have observed this phenomenon in one additional patient.

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Laryngoscope design

To the Editor:
I would like to make some comments on "An analysis of laryngoscope blade shape etc," by Drs. Marks, Hancock and Charters – in the March 1993 issue of the CJA. The primary purpose of this very stimulating study was to describe a novel laboratory method of evaluating existing and future laryngoscope blades. The results also have important, immediate clinical implications. The superiority of the larger Macintosh (Penlon) blades over straight blades is clearly demonstrated. This is no surprise; these blades are preferred by the majority of anaesthetists since their inception 50 yr ago. Another more important finding is not given the prominence it deserves. According to the measurements the Macintosh #4 blade is superior to #3 blade – even at 12 cm and much more so at 15 cm. Unfortunately, no clinical deductions were made by the authors. In fact the two blades are often grouped together as "larger Macintosh blades".

Clinical teachers will be able to refer residents to this study when arguing in favour of the larger blade. Some other clinical observations in the operating room may also convince the resident of the superiority of the #4 blade.

1 Looking at the lateral (outside or left) surface of both blades with their tips aligned, the tallest portion of the vertical flange of the #3 blade will lie very likely between the teeth of an adult whereas the tallest portion of the #4 blade will be well outside the mouth.

2 Comparing the mandibular (inferior) curves of these blades: the diameter of the curve of the #4 blade is longer and the "pocket" that accommodates the tongue is larger. This observation is probably a simplistic explanation why MIT or forward space encroachment is considerably less with the #4 blade.

The clinician may thus deduce:

- The #4 Macintosh blade should be the principal blade for intubation in normal and large-sized adults with teeth. It is far superior in difficult intubations and should be available on emergency trays, in emergency rooms and, most importantly, in the delivery suite.

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REPLY

The support of clinicians is welcome as the work was essentially theoretical. At present investigation of the view obtained at laryngoscopy is an inexact science because of the uncertainty about the number of variables that need to be taken into account. Anatomical variations between patients, differences in laryngoscopy technique and of course blade design all need to be considered. Only when all of these are apppropriately analysed will a satisfactory clinical proof of our model be possible. The obvious starting position is to study rigid blades which must be the most predictable of the variables.

A simplistic way to think of the analysis described is to consider a starting position of knowing the expected distance IT. The blade is then imagined to be inserted to that depth with its tip against the posterior pharyngeal wall and the incisor surface at distance IT touching the upper incisors. As far as the analysis is concerned the efficiency of the blade depends firstly on how far forward the tip can rotate if contact with the incisors is maintained. This is essentially determined by the mandible and reflected in the angle MIT. Secondly, the blade shape may block the eyeline view to the target which is reflected in angle EIT. As both these angles are measured from the upper incisors, for any given situation the simple combination MIE, the sum of the two angles, is a measure of the effective width of the blade relative to how far the mandible allows it to rotate forward. The relevance of incisor contact and mandibular recession or otherwise are obviously critical for this model.

An alternative model, when the blade tip is imagined to be stationary in contact with an optimally positioned hyoid, describes forward blade rotation up off the incisors.[1] This provides an appropriate description for what Dr. Relle describes as "using other dimensions" under his first comment. This modelling is less interesting for the blades in question because it relates to situations where difficult intubation is progressively more unlikely. It does, however, show that, where space in front of the blade is not a problem, the straight blade rapidly reaches a state where it cannot be bettered simply because its shape provides no obstruction to eyeline view.

There are very good reasons why we chose not to make much of the apparent advantage of the Mac #3 over the Mac #4 blade. Firstly, the differences shown are relatively small. A combined (EIT plus MIT) angular difference of 1° is worth about 2 mm of posterior displacement of the blade tip when IT is 11.5 cm. Secondly, it is important to remember that the traditional rigid blade shapes are not necessarily constructed to any specified standard and differences between manufacturers and possibly even the same manufacturers over a period of time may vary. We referred to this problem particularly in the article. Of the blades we have had available to test formally, the Mac #4 has generally had a slight advantage over its Mac #3 equivalent.

Finally, we would like to add a comment on the Editorial[2] relating to our paper, where McIntyre refers to "encouraging anaesthetists to select the most suitable blade for their purpose, not merely a blade they can just manage successfully." Our eventual goal is to be able to suggest the appropriate blade for a particular patient with whatever anatomical problem preoperative assessment determines.

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Spinal anaesthesia for Caesarean section in a patient with brain neoplasma

To the Editor:

A 19-year-old gravida I, para 0 came to hospital with nausea, vomiting, and swallowing disturbances at 31 wk gestation. She complained of frontal headaches, dysarthria and difficulty in walking. The patient showed symptoms of involvement of the cranial nerves V, VII, VIII, IX, X, and XII on her right. The tenth cranial nerve displayed signs of right-sided recurrent laryngeal nerve paresis and she repeatedly complained of regurgitation. First tomographic scannings and later histological results demonstrated a glioblastoma multiforme originating from the pontomedullary junction and extending to the cerebellum. The fourth ventricle was narrowed but not obstructed. At 34 wk, amniocentesis was performed to predict fetal lung maturity and bloody tinged amniotic fluid was found. At the same time the cardiotocogram displayed a decreasing fetal heart rate due to uteroplacental insufficiency. A partial placental abruption was suspected and an emergency Caesarean section was planned.