never encountered hyperkalaemia of this degree. We believe this to be due to several points. Firstly, the authors do not mention the *total* dose of potassium administered. In our initial experience we measured all potassium data, the total amount delivered being 37.12 ± 13.7 mmol · L^{-1} which produced a potassium concentration of 5.4 ± 0.8 mmol · L^{-1} at the end of cardiopulmonary bypass. Next, we question the choice of antegrade cardioplegia delivery for mitral valve replacement. Retraction of the left atrium for valve exposure leads to distortion and incompetence of the aortic valve and thus to inappropriate delivery of cardioplegia to the coronary arteries and a very "bloody" surgical field. Retrograde delivery techniques are now well established,[3-5] allowing uniform distribution of flow in an uninterrupted manner. Antegrade induction with retrograde delivery of cardioplegia is now our preferred delivery strategy even during coronary artery surgery.

It is not clear what type of electromechanical activity returned during the valve procedure. A pattern of "creeping" waves rather than rhythmic contractions is probably related to calcium overload related to potassium-induced membrane depolarisation,[6] in which case an increase in potassium load is counter-productive. Menasche[7] and Lessana[8] have used the natural calcium-antagonist magnesium in order to circumvent this problem and maintain effective, sustained asystole. Although we have not used magnesium in our perfusate we believe it may be useful in cases where sustained asystole is difficult to maintain, e.g., hypertrophied ventricles.

Although impaired renal function does reduce the effectiveness of the kidneys in clearing potassium during cardiopulmonary bypass, this can be improved with frusemide. Should there be a poor response to this manoeuvre, or in anephric patients, haemofiltration during bypass is effective in maintaining potassium in the physiological range.

Finally, the importance of regular monitoring of serum potassium concentration during the procedure should be stressed. Early intervention with either a diuretic or haemofiltration enables the anaesthetist to prevent hyperkalaemia of the degree reported without necessarily prolonging cardiopulmonary bypass.

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REPLY

We appreciate the interest and comments expressed by Drs. Yam, Fox and Fabri. Their response made us realize that the practice of "Warm Heart Surgery" is indeed widespread and our experience in management of the hyperkalaemic patient might be helpful for other anaesthetists in their patient care.[1]

Since the introduction of warm heart surgery, the practice of retrograde cardioplegia infusion has gradually increased. Its use has been adopted widely, especially in valvular procedures. Indeed, antegrade cardioplegia administration for initial induction, followed by retrograde cardioplegia maintenance, has become the most common cardioplegia management technique in our hospital today.

In our original report, we mentioned that patients received a total dose of potassium chloride of 90 meq. Drs. Yam, Fox and Fabri reported that in their experience, patients received a total potassium dose of 37.12 ± 13.7 "mmol · L^{-1}" [sic], "mmol · L^{-1}" presumably means "meq," resulting in a post-cardiopulmonary bypass potassium concentration of 5.4 ± 0.8 mmol · L^{-1}. From their data, it appears that up to 50 meq of potassium infused for myocardial preservation can be administered safely.

In our patient, the electromechanical activity that returned during cardiopulmonary bypass was rhythmic in nature. The term "creeping" waves is not familiar to us. During hyperkalaemia cardioplegia induced diastolic standstill, intracellular calcium concentration slowly increased during ischaemia. Left ventricular contracture could also be demonstrated.[2] *However, this phenomenon is by no means unique to high potassium solution induced myocardial standstill. In both a high magnesium solution induced myocardiam arrest, or calcium channel blocker*

caused hypocontractile myocardium, a similar phenomenon was observed. The effect of an additional potassium or magnesium ion infusion when intracellular calcium concentration began to increase was not assessed,[2] and the assertion that an extra potassium infusion is counterproductive must be treated as speculative. Menasche et al.[3] and Lessana et al.[4] reported their observation during warm blood cardioplegia, but did not address the issue of using magnesium, a calcium antagonist, to treat incomplete myocardial arrest. Actually, Menasche et al. reported the prompt extermination of returning electromechanical activity by increasing the potassium concentration of the cardioplegia.[3]

In our article, the contribution of renal insufficiency and the effect of potassium sparing diuretics on the ultimate hyperkalaemia was mentioned, and haemofiltration during cardiopulmonary bypass was recommended. We appreciate that Drs. Yam, Fox and Fabri agree.

We agree that blood chemistry profiles such as arterial blood gas analysis and electrolyte concentration must be monitored closely during cardiopulmonary bypass. Following a hyperkalaemia experience, we have reduced the time between blood chemistry profiles to 30 min.

In conclusion, we agree with Drs. Yam, Fox and Fabri that careful selection of cardioplegia infusion, close monitoring of the patient's blood chemistry profile and timely therapeutic management are essential for optimal patient care.

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Laryngeal mask airway: defining the limits

To the Editor:

The letter from Williams and Bailey entitled "Management of failed oral fibreoptic intubation with LMA insertion under topical anaesthesia"[1] raises questions about standards of care. That the LMA can be inserted in the awake patient is valuable information. However, the details of the case deserve some scrutiny. Guidelines for the use of the LMA have been elucidated by Fisher *et al.*[2] Among the conditions said to be unsuitable for management with the LMA were aspiration risk and difficult airway access: both existed in the case presented.

While many anaesthetists have used the LMA for nasal surgery without problems, the theoretical concern of aspiration remains. The LMA offers no protection from reflux of gastric contents.[3] This would include blood and irrigation fluid "swallowed" during nasal surgery even in the presence of a throat pack. A reference was cited supporting the ability of the LMA to prevent dye placed in the mouth from entering the larynx.[4] However, in this study, using only 10 ml of 0.1% methylene blue, there was a "minimal leak" in 4 of 64 patients, and a small pool of dye within the mask in one patient whose mask had been partially displaced during draping. No mention was made of examination of the esophagus for dye. In addition, cases of severe aspiration during LMA anaesthesia have been published.[5] It is our opinion that, until controlled clinical trials have demonstrated the safety of using the LMA in this clinical setting, a conservative approach should be adopted.

It seems unwise for a patient, who has already presented an impossible intubation, to undergo general anaesthesia with the LMA for elective surgery. Should the need for urgent intubation arise, direct tracheal access from the neck may be impossible. If this case could not have been done under local anaesthesia, awake blind or fibreoptic intubation through LMA would have been a safe and relatively easy option.

The LMA is an ingenious device of great utility and popularity. Unfortunately, the practical importance of its theoretical risks has not yet been determined. Again, until specific, controlled clinical trials examining large populations, have been published, we advocate a conservative approach based on these theoretical concerns.

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