Leading Article

ACE inhibitors and anaesthesia

I. McConachie and T.E.J. Healy

University of Manchester, Department of Anaesthesia, University Hospital of South Manchester, Withington, Manchester M20 8LR, UK.

During the last decade, two angiotensin converting enzyme (ACE) inhibitors, captopril and enalapril, have become accepted into clinical practice and are regarded as effective treatments for hypertension and congestive cardiac failure.¹ A third agent, lisinopril, had recently become available and others are likely to be introduced in the near future. It is clear, therefore, that more patients, who are being treated with these drugs, will present for elective and emergency anaesthesia than has previously been the case. Physicians and anaesthetists must be aware of the associated implications. Severe hypertension is undoubtedly a risk factor for anaesthesia, especially if it is poorly controlled.² Adequate control of hypertension, smooth anaesthesia, choosing agents for their desired cardiovascular properties, and awareness of potential drug interactions are essential if the risk of adverse events is to be minimized. Anaesthetic agents generally interact with antihypertensive drugs in a predictable fashion and such interactions are usually of little consequence. ACE inhibitors may pose special problems by virtue of their modes of action, namely: reduction in angiotensin II, and aldosterone formation, blockade of the effects of renin and inhibition of bradykinin breakdown. Despite the initial reduction in aldosterone levels these often return to normal and the natriuretic effect may be due to the reduction in angiotensin II.³ Plasma volume has generally been found to be normal although cardiac preload is reduced.⁴ However, it is important to realize that the renin response to haemorrhage or hypotension will be greatly attenuated and therefore normal homeostatic reflexes will be impaired. In addition, the 'normal' increase in blood pressure with surgical stimulation corresponding to an increase in renin activity will be modified.⁵

It has come to our attention that many anaesthetists, especially junior anaesthetists, do not appreciate the potential problems associated with these agents and this is due to the paucity of clinical trials or

infrequent case reports on ACE inhibitors and anaesthesia.

Recently we have seen cases of severe, unexpected hypotension at induction of anaesthesia in well controlled hypertensive patients on monotherapy with captopril. This hypotension was persistent and only reversed by the infusion of large volumes of fluid. ACE inhibitors used to be reserved for patients with severe hypertension but are now prescribed increasingly by general practitioners for any patient with hypertension despite their not being recommended as first line treatment for hypertension.¹ The increasing use of ACE inhibitors as monotherapy for hypertension may increase the incidence of such adverse anaesthetic occurrences.

On the positive side, when controlled hypotension is desirable during general anaesthesia, ACE inhibitors may contribute and reduce the requirements for other agents such as sodium nitroprusside,⁶ and thus reduce the potential for cyanide toxicity during long operations.

The use of ACE inhibitors in patients with congestive cardiac failure is also increasing due to their beneficial effects on symptomatology and a reduction in mortality.⁷ However, hypotension may be a problem, particularly with enalapril,⁸ with the potential for myocardial ischaemia and this again may also be increased during induction of anaesthesia. Compared with other vasodilators, ACE inhibitors are more likely to be associated with hypoperfusion⁹ particularly so when their use is preceded by a diuretic. This compounds the fact that they are, in any case, less likely to retain fluid and could conceivably increase the magnitude of the reduction of blood pressure that may occur at induction of anaesthesia. The blood volume is relatively reduced when these patients are compared with those treated with other vasodilators. Hypotension with captopril has been shown to be more likely if the patient is sodium and volume depleted¹⁰ and therefore prolonged fasting before elective anaesthesia may increase the incidence of hypotension.

In conclusion, although ACE inhibitors are therapeutically effective, their widespread use may contribute to anaesthetic problems (and possibly to

Correspondence: Professor T.E.J. Healy, M.Sc., M.D., F.F.A.R.C.S.

Received: 20 December 1988

anaesthetic morbidity and mortality) unless anaesthetists are familiar with their actions. Studies are needed to define exactly their effects during the perioperative period but none of these has yet been published. It is to be hoped that after careful examination and with increasing experience, these agents may be demonstrated to be safe and even specifically

indicated for patients with hypertension or congestive cardiac failure undergoing general anaesthesia. In the meantime we suggest that anaesthetists should be cautious and echo a recent leading article in the *Lancet* and urge doctors to 'view new developments critically'.¹¹

References

1. Breckenridge, A. Angiotensin converting enzyme inhibitors. *Br Med J* 1988, **296**: 618–620.
2. Prys-Roberts, C. Anaesthesia and hypertension *Br J Anaesth* 1984, **56**: 711–725.
3. Sanchez, R.A., Marco, E., Gilbert, H.B. *et al.* Natriuretic effect and changes in renal haemodynamics induced by enalapril in essential hypertension. *Drugs* 1985, **30** (Suppl 1): 49–58.
4. Messerti, F.H. & Ventura, H.O. Cardiovascular pathophysiology of essential hypertension: a clue to therapy. *Drugs* 1985, **30** (Suppl 1): 25–34.
5. Bailey, D.R., Miller, E.D., Kaplan, J.A. & Rogers, P.W. The renin-angiotensin-aldosterone system during cardiac surgery with morphine-N₂O anesthesia. *Anesthesiology* 1975, **42**: 538–544.
6. Woodside, JR, J., Garner, L., Bedford, R.F. *et al.* Captopril reduces the dose requirement for sodium nitroprusside induced hypotension. *Anesthesiology* 1984, **60**: 413–417.
7. The CONSENSUS Trial Study Group. Effects of enalapril on mortality in severe congestive heart failure: results of the Cooperative North Scandinavian Enalapril Survival Study (CONSENSUS). *N Engl J Med* 1987, **316**: 1429–1435.
8. Packer, M., Lee, W.H., Yushak, M. & Medina, N. Comparison of captopril and enalapril in patients with severe chronic heart failure. *N Engl J Med* 1986, **315**: 847–853.
9. Packer, M. The role of vasodilator therapy in the treatment of severe chronic heart failure. *Drugs* 1986, **32** (Suppl 5): 13–26.
10. Heel, R.C., Brogden, R.N., Speight, T.M. & Avery, G. Captopril: a preliminary review of its pharmacological properties and therapeutic efficacy. *Drugs* 1980, **20**: 409–452.
11. Leading article. ACE inhibitors – the trickle becomes flood. *Lancet* 1988, **ii**: 885–886.