Angiotensin-converting enzyme inhibitors in the perioperative period

Angiotensin-converting enzyme (ACE) inhibitors inhibit the enzyme that cleaves angiotensin I to form angiotensin II. They are potent vasodilators as they decrease concentrations of angiotensin II and noradrenaline and increase concentrations of bradykinin and nitric oxide. They reduce secretion of aldosterone and antidiuretic hormone, thus reducing salt and water reabsorption by the kidney (Groban and Butterworth, 2006).

Continuing use of angiotensin-converting enzyme inhibitors

Continued use of ACE inhibitors leads to preservation of perfusion of organs such as the renal and gastrointestinal systems. This is caused by inhibition of the profound vasoconstriction caused by angiotensin II and consequent increased perfusion of vital organs at the expense of other systems (e.g. mesenteric and renal circulation). Ryckwaert and Colson (2001) showed that preoperative administration of an intravenous ACE inhibitor improved cardiac output and renal perfusion during cardiac surgery in patients with ischaemic heart dysfunction. The improvement in renal perfusion was sustained up to postoperative day seven.

Studies have shown no difference in the occurrence of hypotension during general anaesthesia between those who continue or those who stop taking ACE inhibitors. Comfere et al (2005) showed that those who continued their ACE inhibitors to within 10 hours of surgery encountered the same frequency of severe hypotension, vasopressor requirement and morbidity and mortality as those who had discontinued their ACE inhibitor for a longer period of time. Similar findings have been demonstrated in those with valvular heart disease and those undergoing cardiac surgery (Smith and Jackson, 2010).

Intraoperative hypotension in those taking an ACE inhibitor readily responds to vasopressor administration or fluid loading (Colson et al, 1999; Smith and Jackson, 2010). In addition, those who stopped their ACE inhibitor preoperatively had an increased risk of postoperative hypertension and need for intervention (Smith and Jackson, 2010).

Discontinuing use of angiotensin-converting enzyme inhibitors

General anaesthesia, surgery and fluid shifts activate the renin–angiotensin system and the sympathetic nervous system to maintain haemodynamic stability. Inability of the renin–angiotensin system to primarily produce angiotensin II to counteract these effects, as a result of the use of ACE inhibitors, can lead to hypotension during general anaesthesia.

Increased occurrence of hypotension has been seen with continued use of ACE inhibitors preoperatively, particularly in those with co-existing cardiac disease.

Colson et al (1999) state that post-induction hypotension is likely to occur in 10–40% of patients taking ACE inhibitors without any history of cardiac disease. In those with hypertension the likely occurrence increased to 75–100%. Comfere et al (2005) demonstrated that those who had taken an ACE inhibitor in the 10 hours before surgery had a statistically significant risk of moderate hypotension during the first 30 minutes post-induction of general anaesthesia. They advocated discontinuing ACE inhibitors preoperatively (Comfere et al, 2005).

Confounding factors to ACE inhibitor-induced hypotension are common in these patients. These include concurrent use of diuretics, negative inotropic agents, the presence of severe hypertension, ventricular dysfunction and volume depletion (Colson et al, 1999; Smith and Jackson, 2010).

Renal impairment has commonly been associated with use of ACE inhibitors. Concerns have been raised regarding interaction between ACE inhibitors and non-steroidal anti-inflammatory drugs, particularly postoperatively, and the precipitation of acute kidney injury (Smith and Jackson, 2010). Regardless of additional nephrotoxic agents, ACE inhibitors alone can cause acute kidney injury in vulnerable patients. This would be exacerbated by periods of hypotension intraoperatively.

Conclusions

Evidence for the use of ACE inhibitors is qualified in a number of areas of medicine, yet opinion on the continuation or cessation preoperatively is undecided. A risk/benefit analysis of continuing or stopping the ACE inhibitor is necessary. For example, if a patient would be prone to hypotensive-associated side effects, e.g. if he/she had cerebral vascular disease, then cessation may be favoured, while in those taking them for mild hypertension continuation may be valid. Evidence is varied and an appropriately sized randomized control trial is needed to produce clear clinical guidelines. BJHM

Dr Rachael Croft *is Specialist Trainee Anaesthesia in the Department of Anaesthesia, Manchester Royal Infirmary, Manchester M13 9WL,* **Dr Greg Cook** *is Specialist Trainee Anaesthesia and Intensive Care Medicine and* **Dr Stephen Washington** *is Consultant Anaesthetist in the Department of Anaesthesia, University Hospital of South Manchester, Manchester*

Correspondence to: Dr R Croft (croftrachael@hotmail.com)

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Anaesthetic and critical care dilemmas are coordinated by Dr Pervez Sultan and Dr Kate Adams, Specialist Registrars in Anaesthetics, University College Hospital London

Ideas for future dilemmas can be sent to Rebecca Linssen rebecca.linssen@markallengroup.com