Acute renal failure following cardiac surgery

Sir,

We noted with interest the paper by Conlon et al. [1] on factors associated with the development of acute renal failure (ARF) in adults following cardiac surgery, having undertaken a similar study in children and demonstrated comparable results.

The incidence of ARF in children following cardiac surgery varies between 1–5% depending on the definition of ARF and has a reported mortality of between 50–83%. In order to assess the discriminatory value of pre-operative, operative and post-operative variables in predicting recovery of renal function in those developing ARF, we carried out a retrospective review of 2473 infants and children who underwent cardiac surgery between January 1985 and December 1994.

The diagnosis of ARF was made in the presence of an increase in age related plasma creatinine and two or more of the following: (i) Urine output <1 ml/kg/h (infant) and <0.5 ml/kg/h (child) averaged over 4 h and resistant to volume repletion, and intravenous diuretic therapy (Furosemide 2–5 mg/kg); (ii) hyperkalaemia, plasma potassium level on two separate occasions of >6.0 mmol/l; (iii) presence of clinical fluid overload.

Sixty-three (2.5%) developed ARF, of whom two were excluded because of incomplete data collection, and the remaining 61 were divided into two groups. Those in group 1 (n=37) died with no recovery of renal function, while those in group 2 (n=24) did recover renal function, however 12 patients in this group subsequently died. Renal replacement therapy was provided by haemofiltration/haemodiafiltration or peritoneal dialysis and was required in 88% of patients in group 1 and 42% of group 2 (P<0.05).

The majority of those who developed ARF were less than 1 year of age (87%) and less than 5 kg in weight (59%). However, the mean operative age and weight had no bearing on the recovery of renal function. Other pre-operative variables including elevation of plasma creatinine, cyanosis and hypotension did not differ significantly between the two groups. Cardiopulmonary bypass was undertaken in 76% of patients in group 1 and 67% in group 2 with no statistical difference in cardiopulmonary bypass time or aortic cross clamp time.

Post operative hypotension (systolic BP <40 mmHg in infants/<50 mmHg in children) was more common in group 1 (65%) than group 2 (37%) (P<0.05), and was resistant to inotropic and volume support in 30% of group 1 and 8% of group 2 (P<0.05). Dopamine was used as a pressor agent in all patients, with 62% of patients in group 1 and 12% of patients in group 2 requiring two or more pressor agents (P<0.05). In addition, there was a significant difference in the incidence of post-operative haemorrhage between patients in group 1 (51%) and group 2 (21%) (P<0.05), but no difference in the incidence of other post-operative variables.

We observed resistant hypotension to be the most significant variable in both the development of ARF and the failure of renal functional recovery. The underlying inadequate cardiac output arises both directly from myocardial handling, but also as a result of increasing tissue oedema causing myocardial dysfunction. This is consistent with the report from Conlon et al. [1] and others and we agree that extrapolation of tightly controlled study results [2] may not be appropriate to the practicalities of routine clinical management.

Identification of risk factors for the development of irreversible loss of renal function may as suggested by Conlon et al. [1] allow tailoring of the surgical procedure with the increased use of ultrafiltration during cardiopulmonary bypass and optimisation of post-operative cardiac output by both mechanical (e.g. ventricular assist devices (extra-corporeal membrane oxygenation) and pharmacological interventions.

Royal Hospital for Sick Children Ian J. Ramage Glasgow T. James Beattie UK