

Title: THE EFFECT OF AGE ON CEREBRAL BLOOD FLOW AUTOREGULATION DURING HYPOTHERMIC CARDIOPULMONARY BYPASS

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Introduction: Advanced age has been implicated as a risk factor associated with a greater incidence of post-operative neuropsychiatric complications following cardiopulmonary bypass (CPB)^{1,2,3,4,5}. It is possible that advanced age may be associated with decrements in cerebral blood flow (CBF) and/or deleterious alterations in the autoregulation of CBF during CPB. The hypothesis tested is that age alters regional CBF and impairs normal autoregulation during hypothermic CPB.

Methods: After approval by IRB and informed consent, CBF measurements were obtained in patients undergoing hypothermic CPB using Xenon¹³³ clearance methodology^{6,7}. Patients were grouped into those less than or equal to 50 years of age (group I - 7 patients) and those greater than 65 years of age (group II - 9 patients). Two extracranial gamma emission detectors were placed over the right and left temporal lobes and the average values from both sites were used to determine CBF. Patients with symptomatic cerebrovascular disease were excluded. All patients received diazepam 0.1mg/kg orally and morphine sulfate 0.1mg/kg intramuscularly approximately 60 and 90 minutes prior to the induction of anesthesia, respectively. Anesthetic management prior to CBF determinations included fentanyl (maximum dose of 100 µg/kg IV), diazepam (maximum dose of 0.2 mg/kg IV), and vecuronium (0.1 mg/kg) as required for neuromuscular blockade. CBF determinations were made over a wide mean arterial pressure (MAP) range at a pump flow of 1.6 l/min/m² and at hypothermic conditions (nasopharyngeal temperature 22-27°C). No vasoactive agents were used during CPB prior to CBF determinations. Blood gas management during the study period was directed at maintaining a pH of 7.4 (range 7.31 - 7.41), PCO₂ of 40mmHg (range 36 - 43), and PO₂ of < 250mmHg (range 94 - 246) which were not corrected for temperature. Mean CBF values were obtained for both groups. The mean values were then compared by Student's 2-tailed unpaired t-test. Linear regression analysis was also applied to both groups to determine the correlation between MAP and CBF.

Results: CBF ranged from 14 to 31 ml/100gm/min in patients in group I and 11 to 49 ml/100gm/min in patients in group II. Mean CBF was 21 ± 5.6 ml/100gm/min in patients in group I and 22 ± 6.5 ml/100gm/min in patients in group II. There was no statistically significant difference between the two groups (p = .3452). There was a poor association between MAP and CBF in both groups: group I - n=11, r=.032, p=.9259 and group II - n=15, r=.13, p=.645.

Discussion: These data demonstrate that age has no effect on CBF during hypothermic CPB throughout a wide range of MAP (30-90 mmHg). Furthermore, there is no correlation between MAP and CBF in either age group, suggesting that autoregulation is preserved in both groups.

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Figure 1:

