Xenon administration immediately after but not before or during cardiopulmonary bypass with cerebral air embolism impairs cerebral outcome in rats.

Abstract:
The neuroprotective properties of xenon might improve cerebral outcome after cardiac surgery using cardiopulmonary bypass. However, in the presence of cerebral air emboli, xenon impaired cognitive and histological outcome in a rat cardiopulmonary bypass model, a result which is due to the property of xenon to expand air bubbles. The current study was designed to assess whether cerebral outcome in the setting of cardiopulmonary bypass with cerebral air embolism could be altered by administration of xenon restricted to periods when the occurrence of cerebral air embolism is unlikely. With institutional review board approval, 40 rats were allocated randomly to one of four groups (n = 10) which determined the period of xenon inhalation: 'before', 'during' or 'after' cardiopulmonary bypass or 'none'. Rats were subjected to 90 min of normothermic cardiopulmonary bypass combined with 10 small cerebral air emboli. Xenon was administered according to group assignment: the 'none' group received no xenon; in the other groups, the lungs were ventilated with 56% xenon before, during or after cardiopulmonary bypass and cerebral air embolism. Motor and cognitive outcomes were tested using the modified hole-board test. Cerebral infarction volumes were determined on postoperative day 21. Animals that received xenon after cardiopulmonary bypass...
bypass and cerebral air embolism had impaired motor function scores [after: median 6.6 (range 0.25-8), before: 0.5 (0-3), during: 1.5 (0.25-2.75), none: 1 (0-1.75)] and cognitive performance [after: 9 (6.5-9), before: 0 (0-5.5), during: 1 (0-5.5), none: 1 (0-4)] compared with all other groups (P < 0.05). Administration of xenon after cardiopulmonary bypass and cerebral air embolism also led to larger cerebral infarction volumes [after: 74 μl (54-157), before: 45 μl (20-82), during: 33 μl (23-54), none: 22 μl (17-78)] compared with the groups that received xenon during cardiopulmonary bypass and cerebral air embolism or no xenon at all (P < 0.05). Xenon administered immediately after cardiopulmonary bypass and cerebral air embolism impaired motor, cognitive and histological outcome in rats. At no time did inhalation of xenon lead to any beneficial effects on cerebral outcome when compared with inhalation of nitrogen.

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