Effects of Halothane on Global and Regional Biventricular Performances and on Coronary Hemodynamics before and during Right Coronary Artery Stenosis in the Dog

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Background: Previously, it was suggested that right ventricular (RV) free wall dysfunction does not necessarily elicit global hemodynamic alterations. This was investigated in a canine model of halothane-induced right coronary artery (RCA) insufficiency.

Methods: Two concentrations (0.8% and 1.6% end tidal) of halothane on global and regional RV and left ventricular (LV) performance and on coronary, pulmonary, and systemic hemodynamics were studied in 10 open-chest dogs first before and, subsequently, during critical RCA stenosis.

Results: In the absence of stenosis, halothane caused progressive and comparable depression of regional and global RV and LV function and reduction of RCA flow. Halothane administered during RCA stenosis caused disproportionate decreases in RCA flow and segment shortening and increases in systolic segment lengths in the area supplied by the stenosed RCA that were approximately twice as great as before stenosis. Such severe regional RV dysfunction was not accompanied by greater depression of global RV and LV pump function (systolic pressures and stroke volume).

Conclusions: In the canine heart with its dominant left coronary system, RCA insufficiency (on the basis of halothane-induced hypotension) caused regional RV dysfunction suggesting ischemia that was not accompanied by global hemodynamic alteration. (Key words: Anesthetics, volatile: halothane. Heart: coronary artery stenosis; coronary hemodynamics; left ventricular function; regional myocardial performance; right ventricular function.)

IN view of widespread coronary artery disease, it is of continued clinical interest to learn to what extent a particular anesthetic technique or agent modifies myocardial performance in the presence of impaired coronary perfusion.1,2 Controversy exists as to whether one volatile anesthetic may have a greater margin of safety than another in the presence of coronary artery stenosis.3-7 When evaluating the literature, it becomes apparent that most studies have focused only on left ventricular (LV) performance and coronary hemodynamics with or without underlying coronary insufficiency in the territory of the left coronary artery.8-12 Comparable studies on the effects of anesthetic drugs on right ventricular (RV) function and coronary hemodynamics in the absence13,14 or presence15 of right coronary artery (RCA) insufficiency are rare. However, although less common than LV myocardial infarction, RV myocardial infarction (generally on the basis of obstructive lesions of the RCA) is, nevertheless, a clinically relevant entity.16 In addition, it often is difficult to compare data directly among different studies because of considerable differences in species, baseline anesthesia, experimental model, degree of coronary artery stenosis, or intervention chosen. Therefore, it was the objective of this investigation to study extensively and compare the effects of halothane on global and regional RV and LV performances and on various circulations before and during critical stenosis of the RCA in a canine model identical to that employed for a similar evaluation of isoflurane.14,15 Similarities in baseline conditions and experimental interventions should render the comparison of data from two different volatile anesthetics more meaningful.

Materials and Methods

Instrumentation

After approval from the local ethics committee on animal research, 10 mongrel dogs of either sex weighing 27–41 kg received preanesthetic medication consisting of intramuscular fentanyl (0.04 mg/kg) and droperidol (2 mg/kg). Anesthesia was induced with

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