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Title : Myocardial Infarct Size Reduction By Thoracic Epidural Anesthesia

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Introduction. The myocardial infarct size (MIS) produced in dogs after a standardized coronary artery occlusion (CAO) may be decreased by pharmacologic interventions. Thoracic epidural anesthesia (TEA) improves regional myocardial blood flow (RMBF) and the endocardial to epicardial blood flow ratio (Endo: Epi). This paper describes the effect of TEA on; 1) MIS, measured by histopathologic and ST segment mapping techniques; 2) systemic hemodynamics, and 3) RMBF.

Methods. Fifteen adult mongrel dogs were anesthetized (thiamylal 25mg/kg. intravenously) and mechanically ventilated, while mean arterial pressure (MAP) and EKG were continuously recorded. The hearts were exposed through a left thoracotomy and suspended in a pericardial cradle. The laminae of the first and second thoracic vertebrae were surgically exposed and an 18 gauge guage catheter placed into the epidural space under direct vision. Subsequently, the dogs were assigned to one of two groups. In group I (n=7), catheters were placed into the left atrium (LA), left ventricle (LV), and the femoral artery (FA) for measurement of LV end-diastolic pressure (LVEDP), the first time derivative of LV pressure at 50mmHg(dP/dt_{50}), RMBF, and cardiac out-put (CO). Flow measurements (CO and RMBF) were obtained using standard radionuclide labeled microsphere techniques. The left anterior descending coronary artery (LAD) was isolated immediately proximal to its first apical diagonal branch and fifteen anterior LV locations selected to obtain an epicardial electrocardiographic map of the number of sites with ST segment elevation over 1 millivolt (N·ST), and the total sum of the ST elevation (Σ·ST). The LAD was then reversibly occluded, and after 15 minutes, MAP, heart rate (HR), LVEDP, dP/dt_{50}, RMBF, CO, N·ST, AND Σ·ST were measured. The heart was then reperfused for one hour after which TEA was produced by epicardial injection of 10 milliliters of 1% lidocaine. Thirty minutes after TEA, the LAD was again occluded, and fifteen after CAO all measurements were repeated. Table I compares the data obtained before and with TEA.

In group II dogs (n=8), the LAD was occluded proximal to its' first apical diagonal branch and the chests closed. One hour after CAO the dogs were randomized to receive 10 milliliter epidural injections of either 1% lidocaine (n=4) or normal saline (n=4), given hourly for 12 hours after CAO. Dogs receiving normal saline also received simultaneous intramuscular injections of 10 milliliters of 1% lidocaine. Subsequently the dogs were sacrificed the hearts removed, and the LV sectioned into 1.5 centimeter transverse slices. The tissue was incubated at 37°C for 30 minutes in triphenyl tetrazolium chloride to delineate the infarction. MIS was measured by direct tissue weight after dissecting normal from infarcted myocardium. Data from saline and lidocaine treated dogs are shown in Table II.

Results.

TABLE I
Hemodynamic, RMBF, and ST Segment Data Obtained 15 Minutes After CAO

	MAP (mmHg)	HR (MIN^{-1})	LVEDP (mmHg)	dP/dt_{50} (mmHg·sec^{-1})	CO ($L \cdot min^{-1}$)	Epicardial RMBF Normal ($ml \cdot min^{-1} \cdot 100gm^{-1}$)	Epicardial RMBF Infarct	Endo:Epi Normal	Endo:Epi Infarct	N·ST (sites)	Σ·ST (mv)
Pre TEA	98±8	138±5	5±1	2024±122	2.1±.3	86±9	21±5	1.03±.03	.54±.08	8±1	56±11
With TEA	93±5	*112±8	6±1	*1666±153	*1.8±.3	79±6	*27±4	.99±.03	*.79±.10	*2±1	*18±8

Mean values ± 1 SEM N=7
*p less than 0.05 when compared to before TEA values

TABLE II
Infarct Size Data

	Distance: Coronary Ostium to CAO Site (CM)	% of LV Distal to CAO	MIS by Tissue Weight (GM)	MIS as % of LV
CONTROL (epidural saline) N=4	2.6±.2	78±3	41±4	31±2
TREATED (epidural Lidocaine) N=4	2.7±.3	71±2	*22±2	*19±1

Mean values ± 1 SEM
*p less than 0.05 when compared to control values

Discussion. These data demonstrate that in a canine model of acute myocardial infarction, TEA with lidocaine reduces MIS, and improves the distribution of RMBF within ischemic tissue. These results may have potential clinical value for the treatment of myocardial infarction.