Amiodarone versus lidocaine and placebo for the prevention of ventricular fibrillation after aortic crossclamping: A randomized, double-blind, placebo-controlled trial

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Objective: Ventricular fibrillation occurs commonly after aortic crossclamping in patients undergoing cardiac surgery. Ventricular fibrillation increases myocardial oxygen consumption, and defibrillation may harm the myocardium. Thus, a pharmacologic approach to decreasing the incidence of ventricular fibrillation or the number of shocks required may be beneficial. The goal of this study was to evaluate whether amiodarone or lidocaine was superior to placebo for the prevention of ventricular fibrillation after aortic crossclamping in patients undergoing a variety of cardiac surgical procedures.

Methods: Patients undergoing cardiac surgery requiring aortic crossclamping were randomized to receive lidocaine 1.5 mg/kg, amiodarone 300 mg, or placebo before aortic crossclamp removal. The primary outcomes were the incidence of ventricular fibrillation and the number of shocks required to terminate ventricular fibrillation.

Results: A total of 342 patients completed the trial. On multivariate analysis, there was no difference in the incidence of ventricular fibrillation among treatment groups. The number of required shocks was categorized as 0, 1 to 3, and greater than 3. On multivariate analysis, patients receiving amiodarone required fewer shocks to terminate ventricular fibrillation (odds ratio, 0.51; 95% confidence interval, 0.31-0.83; $P = .008$ vs placebo). There was no difference between lidocaine and placebo in the number of required shocks (odds ratio, 0.86; 95% confidence interval, 0.52-1.41; $P = .541$).

Conclusions: In patients undergoing a variety of cardiac surgical procedures, neither amiodarone nor lidocaine reduced the incidence of ventricular fibrillation. Amiodarone decreased the number of shocks required to terminate ventricular fibrillation. (J Thorac Cardiovasc Surg 2012;144:1229-34)

The incidence of ventricular fibrillation (VF) after release of the aortic crossclamp in patients undergoing cardiac surgery has been reported to be between 45% and 100%.¹⁻⁷ Multiple mechanisms have been proposed to explain the high incidence of VF, including ischemia-mediated increases in reentry, automaticity, and reperfusion injury.⁸⁻¹⁰ VF may result in increased myocardial oxygen consumption, distension of the ventricle with resultant increases in wall tension, and acidosis of the myocardial tissue.¹¹⁻¹⁴ These changes may be particularly pronounced in the hypertrophied ventricle when the mean arterial blood pressure is less than 50 to 60 mm Hg.¹⁵⁻¹⁷

Although VF is known to adversely affect the heart, the “gold standard” treatment, internal direct-current shock, also may be harmful. Animal models using monophasic damped sine waveform shocks suggest that defibrillation leads to decreased myocardial performance and microscopic damage to myocytes and that the injury is more pronounced with repeated shocks with a short time interval between shocks.^{18,19} Given these findings, the prevention of reperfusion VF or a decrease in the number of defibrillation attempts required to terminate VF may be of benefit in preserving myocardial function after cardiopulmonary bypass (CPB).

Lidocaine, a class I (sodium channel blocking) antiarrhythmic drug, has a long history of use in cardiac surgery for the prevention of VF. Several studies have shown its efficacy in preventing VF and decreasing the number of shocks required to defibrillate VF when it does occur.^{1-5,20} However, all of these studies have been performed in relatively homogeneous patient populations, that is, patients undergoing coronary artery bypass grafting (CABG). Intravenous amiodarone has multiple mechanisms of action, including blockade of potassium, sodium, and calcium channels, as well as alpha and beta adrenergic antagonism.²¹ Amiodarone has been well studied in the setting of out-of-hospital cardiac arrest. Randomized, blinded

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Abbreviations and Acronyms

CABG	= coronary artery bypass grafting
CI	= confidence interval
CPB	= cardiopulmonary bypass
OR	= odds ratio
VF	= ventricular fibrillation

trials in adults have shown amiodarone to be superior to both placebo and lidocaine in the resuscitation of patients with VF or pulseless ventricular tachycardia.^{22,23} Other studies have shown amiodarone to improve the response of VF to shocks.^{24,25} To date, 2 studies have evaluated amiodarone for the prevention of VF after aortic crossclamping with mixed results.^{1,6}

The goal of the present study was to evaluate whether amiodarone or lidocaine was superior to placebo for the prevention of VF after aortic crossclamping in patients undergoing a variety of cardiac surgical procedures.

MATERIALS AND METHODS

This randomized, double-blind, placebo-controlled trial was conducted at Mayo Clinic in Rochester, Minnesota. The study was approved by the Mayo Foundation Institutional Review Board, and all patients gave written, informed consent. Patients were eligible for inclusion if they were aged more than 18 years and undergoing an elective cardiac procedure that was expected to include crossclamping of the aorta. Women of childbearing age were included only if they agreed to the use of birth control for at least 5 months after the procedure. Patients were excluded for an allergy to amiodarone or a history of organ dysfunction due to previous amiodarone use. Patients were also excluded if it was expected that they would require more than mild systemic hypothermia ($<32^{\circ}\text{C}$) during CPB. Before operation, subjects were randomized in a 1:1:1 fashion to receive amiodarone (group A), lidocaine hydrochloride (group L), or saline (group P) before aortic crossclamp removal. All study drugs were prepared by a research pharmacist and diluted to 12 mL total volume. Anesthesiologists, surgeons, and CPB perfusionists were strictly blinded as to the content of the syringes.

Procedure

After consent was obtained and randomization had occurred, patients were brought to the operating room. Induction and maintenance of anesthesia were at the discretion of the anesthesiologist and included the use of midazolam, sodium thiopental, propofol or ketamine, fentanyl or sufentanil, isoflurane, and pancuronium or vecuronium. Hemodynamic monitoring included the use of an arterial catheter and central venous catheter with or without a pulmonary artery catheter.

The cannulation sites for CPB were at the discretion of the cardiac surgeon and dependent on the operation. The aorta was cannulated with a patient size-appropriate cannula. Venous cannulation was obtained with a single 2-stage cannula in the right atrium or separate cannulae in the superior and inferior vena cavae. Anticoagulation was initiated with 300 u/kg of heparin and maintained according to an activated clotting time (HemoChron 801, International Technidyne, Edison, NJ) of more than 500 seconds. Perfusion during CPB used nonpulsatile flow with Sarns 9000 (Terumo Cardiovascular Systems, Ann Arbor, Mich) or Sorin S5 (Sorin, Munich, Germany) CPB equipment and a Terumo membrane oxygenator. CPB flows were maintained at 2.0 to $2.4\text{ L}\cdot\text{min}^{-1}\cdot\text{m}^{-2}$. Mean arterial pressure was maintained at 60 to 80 mm Hg during CPB. Hyperkalemic cold blood cardioplegia was given every 20 to 30 minutes for myocardial

protection (Table 1). Cardioplegia consisted of blood mixed with crystalloid components in a ratio of 4 parts blood to 1 part crystalloid. The crystalloid component consisted of lactated Ringer's solution with 50 mEq/L of sodium bicarbonate and either 100 mEq/L (for induction of cardiac arrest) or 50 mEq/L (for maintenance of cardiac arrest) of potassium. Warm, potassium-free restorative cardioplegia was not administered before cross-clamp removal. Septal myocardial temperature readings as a marker of adequacy of cardioplegia delivery were not used.

The surgeon notified the anesthesia and perfusion teams before anticipated removal of the aortic crossclamp with a goal of administering the study drugs approximately 3 minutes (3 circulation times) before cross-clamp removal. At this time, patients in group A received 300 mg of amiodarone, patients in group L received 1.5 mg/kg of lidocaine, and patients in group P received placebo (saline). All study drugs were administered via the CPB venous reservoir. Patients were not given magnesium sulfate during the study period because of potential confounding effects.

If VF occurred after aortic crossclamp removal, patients received up to 3 consecutive rectilinear biphasic waveform shocks using internal paddles with 10 J of energy (Zoll R Series Defibrillator, Zoll Medical, Chelmsford, Mass). If defibrillation was unsuccessful after 3 attempts using 10 J, a second dose of study medication was administered on the basis of prior randomization. Patients in group A received an additional 150 mg of amiodarone, patients in group L received 1.5 mg/kg of lidocaine, and patients in group P received placebo (saline). Defibrillation was again attempted, but escalating energy levels were used (first shock 10 J, second shock 20 J, and third shock 30 J). As a safety measure, the patient's randomization was made immediately available to the team in the operating room after the second dose of medication. The patient's group assignment was noted on paper and delivered in a sealed, opaque envelope with the study drugs to the operating room. Thus, should VF persist after the second dose of study medication and second set of shocks, the envelope could be immediately opened and the entire team would be aware of what medications had already been administered. At this point, further therapy was at the discretion of the consultant anesthesiologist and surgeon.

Outcome Measurements

Patient demographics were recorded and included age, medical comorbidities, current medication use, left ventricular ejection fraction, type of operation, duration of CPB, duration of aortic crossclamping, and times of cardioplegia administration. Two primary outcomes were compared among the 3 study groups: (1) the incidence of VF after removal of the aortic crossclamp and (2) the number of defibrillations required to terminate VF.

In addition, we sought to determine the relationship between left ventricular mass and the incidence of VF after aortic crossclamp removal. To this end, the patients' charts were manually reviewed by a single, blinded investigator and recorded left ventricular mass as obtained from a transthoracic echocardiogram performed at the Mayo Clinic within 1 year of operation.

Sample Size

On the basis of the available literature, the expected overall incidence of VF after removal of the aortic crossclamp is approximately 70%. By using a chi-square test with 80% power and an alpha of 0.0167 to adjust for multiple comparisons (given the total of 3 comparisons, $0.05/3 = 0.0167$ was used in the calculation.), we estimated that we would need 113 patients in each group to show a 30% reduction in the incidence of VF with amiodarone. Given the potential for patient dropouts, we planned to enroll 120 patients in each group for a total study population of 360 patients.

Statistical Methods

All data including primary and secondary outcome data were analyzed on the basis of the intention to treat principle. Categorical baseline characteristics and outcomes were compared between groups using chi-square tests or

TABLE 1. Demographics

	Control n = 112	Lidocaine n = 115	Amiodarone n = 115	P value
Age (y)	63.6 ± 13.0	62.7 ± 13.9	63.3 ± 13.6	.91
Height (cm)	174 ± 10.2	172.9 ± 10.2	171 ± 10.2	.039
Weight (kg)	91.2 ± 20.8	88.1 ± 19.5	86.9 ± 18.4	.429
Gender				
Male	82 (73.2%)	81 (70.4%)	74 (64.3%)	.333
Female	30 (26.8%)	34 (29.6%)	41 (35.7%)	
Left ventricular ejection fraction (%)	62.8 ± 11.7	62.7 ± 11.5	62.7 ± 10.8	.862
Procedure				
CABG only	20 (17.9%)	15 (13.0%)	18 (15.7%)	.806
Valve only	31 (27.7%)	37 (32.2%)	38 (33.0%)	
Septal myectomy	34 (30.4%)	30 (26.1%)	34 (29.6%)	
Multiple procedures	27 (24.1%)	33 (28.7%)	25 (21.7%)	
Medical history				
Diabetes mellitus	14 (12.5%)	14 (12.2%)	16 (13.9%)	.916
Coronary artery disease	45 (40.2%)	41 (35.7%)	42 (36.5%)	.757
Current smoker	9 (8.0%)	11 (9.6%)	7 (6.1%)	.618
COPD	5 (4.5%)	7 (6.1%)	3 (2.6%)	.436
Hypertension	48 (42.9%)	37 (32.2%)	55 (47.8%)	.048
History of dysrhythmias				
Atrial fibrillation	17 (15.2%)	22 (19.1%)	23 (20.0%)	.605
Atrial flutter	1 (0.89%)	2 (1.7 %)	4 (3.5%)	.373
Ventricular	3 (2.7%)	3 (2.6%)	0 (0%)	.213
Preoperative medications				
Beta-blocker	73 (65.2%)	73 (63.5%)	67 (58.3%)	.532
ACEI/ARB	29 (25.9%)	31 (27.0%)	43 (37.4%)	.112
Statin	60 (53.6%)	42 (36.5%)	46 (40.0%)	.024
Digoxin	7 (6.3%)	4 (3.5%)	7 (6.1%)	.574
Amiodarone	2 (1.8%)	7 (6.1%)	5 (4.3%)	.259
Duration of aortic crossclamp (min)	53.3 ± 36.8	46.5 ± 56.1	47.4 ± 32.1	.447
Duration of CPB (min)	78.0 ± 48.7	74.3 ± 40.0	70.8 ± 64.0	.444
Time between cardioplegia administrations (min)	21.0 ± 9.1	20.8 ± 8.9	21.4 ± 9.3	.956
Time from study drug administration to crossclamp removal (min)	3.2 ± 7.6	3.0 ± 5.6	3.6 ± 5.4	.415

Data are presented as mean ± standard deviation for continuous variables and n (%) for categorical variables. CABG, Coronary artery bypass grafting; COPD, chronic obstructive pulmonary disease; ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; CPB, cardiopulmonary bypass.

Fisher exact test (where appropriate), whereas continuous variables were compared using analysis of variance or Kruskal–Wallis tests (where appropriate). Because a few baseline variables were significantly different between groups (Table 1), normal and ordinal logistic regression models were used to find univariate and multivariate predictors for VF and number of shocks. Then, the variable containing the treatment groups was forced in each multivariate model to detect the difference after adjusting for confounding variables. The multivariable model considered all univariately significant variables ($P < .05$) with model selection using the stepwise method (backward and forward methods resulted in the same model). All statistical tests were 2-sided with the alpha level set at 0.05 for statistical significance.

RESULTS

A total of 360 patients were enrolled in the trial. Eighteen patients were excluded after enrollment for protocol violations, leaving 115 patients in group A, 115 patients in group L, and 112 patients in group P (Figure 1). A comparison of patient and procedural characteristics between study groups is shown in Table 1. Patients in group A were more likely to

have hypertension (47.8% vs 32.2% in group L and 42.9% in group P; $P = .048$) and patients in group P were more likely to be taking a statin medication at the time of surgery (53.6% vs 36.5% in group L and 40.0% in group A; $P = .024$). The mean left ventricular ejection fraction was normal. Eighteen patients had ejection fractions less than 40%, and these were evenly distributed between study groups ($P = .221$) (data not shown).

In total, 196 patients (57.3%) experienced VF after aortic crossclamp removal. The only univariate predictor of VF was operation type, with patients undergoing septal myectomy having a higher incidence of VF than patients undergoing CABG (odds ratio [OR], 5.09; 95% confidence interval [CI], 2.47-10.47; $P < .001$) (Table 2). In contrast, advancing age, preoperative digoxin or amiodarone use, and longer aortic crossclamp and CPB times reduced the occurrence of VF. When univariate predictors were placed in a multivariate model, septal myectomy (OR, 5.59; 95% CI,

FIGURE 1. Flow diagram of patient enrollment and dropouts. CPB, Cardiopulmonary bypass.

2.69-11.26; $P < .001$) and valve surgery (OR, 2.12; 95% CI, 1.07-4.19; $P = .031$) became positive predictors of VF. Preoperative amiodarone use was protective against VF (OR, 0.24; 95% CI 0.07-0.82; $P = .023$) (Table 3). There was no effect of acute administration of amiodarone or lidocaine on the occurrence of VF.

TABLE 2. Univariate analysis of incidence of ventricular fibrillation after aortic crossclamp removal and number of shocks required to terminate ventricular fibrillation

Category	OR	95% CI	P value
Incidence of VF after crossclamp removal			
Amiodarone vs placebo	0.65	0.39-1.11	.117
Lidocaine vs placebo	0.80	0.47-1.37	.433
Type of operation			
Valve vs CABG	1.92	0.98-3.77	.058
Myectomy vs CABG	5.09	2.47-10.47	<.001
Multiple procedures vs CABG	1.86	0.92-3.74	.083
No. of shocks required			
Amiodarone vs placebo	0.51	0.32-0.84	.008
Lidocaine vs placebo	0.82	0.52-1.33	.424
Type of operation			
Valve vs CABG	1.97	1.03-3.76	.040
Myectomy vs CABG	3.87	2.00-7.50	<.001
Multiple procedures vs CABG	1.83	0.93-3.58	.078

VF, Ventricular fibrillation; OR, odds ratio; CI, confidence interval; CABG, coronary artery bypass grafting.

TABLE 3. Multivariate analysis of incidence of ventricular fibrillation

	OR	95% CI	P value
Amiodarone vs placebo	0.65	0.37-1.12	.121
Lidocaine vs placebo	0.85	0.48-1.47	.577
Type of operation			
Valve only vs CABG	2.12	1.07-4.19	.031
Septal myectomy vs CABG	5.59	2.69-11.26	<.001
Multiple procedures vs CABG	1.98	0.97-4.01	.059
Preoperative amiodarone use	0.24	0.07-0.82	.023

OR, Odds ratio; CI, confidence interval; CABG, coronary artery bypass grafting.

For the outcome of the number of shocks required to terminate VF, patients were categorized as receiving 0, 1 to 3, or more than 3 shocks. We chose to categorize the number of shocks because the number of shocks did not follow normal distribution with 75% of patients requiring 2 or fewer shocks. Univariate predictors of patients requiring fewer shocks included receiving amiodarone versus placebo, older age, preoperative use of amiodarone or digoxin, and longer duration of CPB. Univariate predictors of patients requiring a larger number of shocks included septal myectomy versus CABG and valve surgery versus CABG (Table 2). In the multivariate model predicting the number of shocks required to terminate VF, amiodarone was superior placebo (OR, 0.51; 95% CI, 0.31-0.83; $P = .008$). Lidocaine provided no benefit in reducing the number of shocks required to terminate VF (OR, 0.86; 95% CI, 0.52-1.41; $P = .541$). Predictors of an increased number of shocks required included valve surgery versus CABG, septal myectomy versus CABG, and multiple combined procedures versus CABG (Table 4). Preoperative amiodarone use decreased the number of shocks required to terminate VF (OR, 0.24; 95% CI, 0.07-0.79; $P = .019$).

We did attempt a subgroup analysis based on the type of operation. Patients were divided into groups consisting of isolated CABG (N = 53), valve surgery (N = 106), septal myectomy (N = 98), and combined procedures (N = 85). In this subgroup analysis, neither lidocaine nor amiodarone decreased the incidence of VF or the number of shocks

TABLE 4. Multivariate analysis of number of defibrillations (categorized into 0, 1-3, and >3)

	OR	95% CI	P value
Amiodarone vs placebo	0.51	0.31-0.83	.008
Lidocaine vs placebo	0.86	0.52-1.41	.541
Type of operation			
Valve vs CABG	2.13	1.11-4.09	.024
Septal myectomy vs CABG	3.81	1.98-7.35	<.001
Multiple procedures vs CABG	2.03	1.04-3.96	.038
Preoperative digoxin use	0.39	0.14-1.10	.075
Preoperative amiodarone use	0.24	0.07-0.79	.019

OR, Odds ratio; CI, confidence interval; CABG, coronary artery bypass grafting.

required to terminate VF in the specific subsets of patients (data not shown).

Given the relationship between patients undergoing septal myectomy and the high incidence of VF, we analyzed the effect of left ventricular mass on the incidence of VF. A total of 230 patients had undergone transthoracic echocardiography within 1 year before operation. Left ventricular mass was recorded from the available echocardiography reports. After adjusting for significant predictors that were found to affect VF and the need for defibrillatory shocks among the whole cohort, increasing left ventricular mass was predictive of VF after aortic crossclamp removal (OR, 1.04; CI, 1.01-1.08; $P = .009$ for every 10-g increase in left ventricular mass) and the need for increasing number of defibrillatory shocks (OR, 1.05; CI, 1.02-1.08; $P < .001$ for every 10-g increase in left ventricular mass). Given the fact that left ventricular mass was available for only 230 of the 342 patients in the study population, left ventricular mass was not used in the final multivariate models.

DISCUSSION

In this trial of patients undergoing a variety of cardiac surgical procedures, neither amiodarone nor lidocaine given 3 minutes before aortic crossclamp removal decreased the incidence of VF. However, amiodarone, but not lidocaine, decreased the number of shocks required to terminate VF.

Several studies have shown lidocaine to decrease the incidence of reperfusion VF when compared with control groups.^{1-3,5,6} All of these studies were performed in patients undergoing CABG. Thus, the current trial differs from these studies in that we included a variety of surgical procedures, including CABG, valve surgery, septal myectomy for the treatment of hypertrophic obstructive cardiomyopathy, and combined procedures. Our study also differed from previous studies in terms of lidocaine dosing. Two of the previous studies used doses of 100 mg of lidocaine,^{1,2} 2 studies used doses of 200 mg of lidocaine,^{5,6} and 1 study administered 2 mg/kg of lidocaine.³ The current study used 1.5 mg/kg of lidocaine as the initial treatment dose. Given that the mean weight of the patients in the lidocaine group was 88.1 kg, the mean dose of lidocaine administered would have been 132.2 mg. This dose would have been within the dosing limits reported by other investigators to be successful.

Two studies have investigated the use of amiodarone to prevent VF after aortic crossclamp removal in cardiac surgery. Samantaray and colleagues⁶ randomized 34 patients undergoing CABG to receive 150 mg of amiodarone or placebo before aortic crossclamp removal. The incidence of VF in the amiodarone group was 18% versus 65% in the placebo group ($P = .01$). In a larger trial, Ayoub and colleagues¹ randomized 120 patients undergoing CABG to receive 150 mg amiodarone, 100 mg lidocaine, or placebo 2 minutes before removal of the aortic crossclamp. These

investigators found the incidence of VF to be higher in the groups receiving amiodarone or placebo versus the group receiving lidocaine (48% vs 45% vs 20% respectively, $P = .031$). However, they found the energy required to terminate VF was lower in the patients receiving amiodarone versus the controls (16 ± 7 J vs 25 ± 8 J; $P = .023$).

The dose of amiodarone used in this study was significantly higher than the dose used in the 2 previous investigations (300 vs 150 mg).^{1,6} We selected this dose on the basis of the large volume of distribution of amiodarone and the expected hemodilution in the CPB reservoir. Even with this larger dose, we were unable to replicate the decrease in VF found by Samantaray and colleagues.⁶ Our results were similar to those of Ayoub and colleagues,¹ who found no difference in the incidence of VF, but that VF was more easily terminated in patients receiving amiodarone.

Our study differs from the described investigations.^{1,6} Most important, we included a heterogeneous group of operations, including open cardiac chamber procedures. The fact that patients undergoing valve operations or septal myectomy had both a higher incidence of VF and required a higher number of shocks to terminate VF (Tables 3 and 4) suggests that in addition to the proarrhythmic effects of myocardial ischemia and reperfusion, gaseous air emboli from open-chamber procedures and preexisting myocardial hypertrophy are likely important mediators of VF after aortic crossclamp removal in cardiac surgery. A subgroup analysis of left ventricular mass showed that increasing left ventricular mass likely plays an important role in the development of VF and the success of defibrillatory shocks. The finding that left ventricular mass is a strong predictor of VF and increases the number of shocks required to terminate VF is important and may warrant further research. Unfortunately, this was a secondary finding in our study, and the data were obtained retrospectively. In addition, less than 70% of the study patients had echocardiographic data available for review. These reasons precluded the use of left ventricular mass in our statistical modeling. The fact that this trial included patients undergoing a variety of surgical procedures in a large, tertiary care cardiac surgery practice makes our results applicable to diverse cardiac surgical practice and not just that of patients undergoing isolated CABG.

In addition, our dosing of amiodarone was higher than that in previous investigations. However, this may not have been a large enough dose given the large volume of distribution of amiodarone combined with hemodilution from the CPB reservoir. Although the numbers are small (14 total patients), patients who were taking amiodarone preoperatively had a significantly decreased incidence of VF and required fewer shocks to terminate VF. The numbers are small and the results must be viewed with caution, but they suggest that an intravenous bolus of 300 mg of amiodarone may not be adequate to achieve therapeutic

tissue levels in the myocardium. Future studies aimed at preventing reperfusion VF may focus on preoperative loading of patients with oral amiodarone.

It seems paradoxical that our univariate analyses indicate that older patients and longer CPB and crossclamp times seem to be protective against VF. This is a reflection of the type of operation. The patients undergoing myectomy were younger and have short CPB and crossclamp times compared with patients undergoing CABG. However, our data show that septal myectomy is a strong predictor of reperfusion VF. Thus, it is the operation type and not the age, or CPB and crossclamp duration, that predicts VF. That is why older age and longer CPB and crossclamp times were protective from VF in univariate but not multivariate models.

Study Limitations

The current trial has some limitations. Despite enrolling a heterogeneous surgical population, the mean left ventricular ejection fraction was normal. Thus, it is unclear whether our results are applicable to patients with decreased left ventricular function. Second, as noted earlier, the dose of administered amiodarone may not have been high enough to achieve therapeutic tissue levels given the added circulatory volume of the CPB circuit. Last, the study population included a large number of patients undergoing septal myectomy for hypertrophic obstructive cardiomyopathy. This may be an uncommon patient population for many cardiac surgical centers.

CONCLUSIONS

When applied to patients undergoing a variety of cardiac surgical procedures, neither 300 mg of amiodarone nor 1.5 mg/kg of lidocaine administered 3 minutes before aortic crossclamp removal decreases the incidence of VF. However, amiodarone, but not lidocaine, reduces the number of shocks required to terminate VF after aortic crossclamp removal.

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