THE EFFECT OF INTRAVENOUS DILTIAZEM ON ATRIAL ARRYTHMIAS FOLLOWING CORONARY BYPASS SURGERY

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The effects of diltiazem on the heart rythm and hemodynamic parameters was observed in 4 four cases with supraventricular tachycardia and in 12 cases with atrial fibrillation who underwent coronary bypass surgery. Blood, pulmonary artery, central venous, pulmonary capillary wedge pressures, cardiac index (CI) left ventricular stroke work, pulmonary and systemic vascular resistances (PVR-SVR) were recorded during application. There cases returned to sinus rhythm while the mean heart rate decreased. CI increased at the range of 30-50 % with the increse of LVSWI. Decreases at both SVR and PVR was observed. According to our results, we beleive that diltiazem is one of the first choice drugs for the management of supraventricular rate because of its beneficial hemodynamic effects.

Key words: Coronary bypass surgery, supraventricular tachycardia, diltiazem

Certain supraventricular tachycardias such as sinus tachycardia, atrial flutter or atrial fibrillation can be a cause of problem after open heart surgery, especially after coronary bypass operations because of their increased incidence, and may decrease cardiac output in some patients. To decrease morbidity and mortality in these patients, it is essential to recognize and handle the arrhythmia in early postoperative period. In this study we have investigated the therapeutic and hemodynamic effect of diltiazem, a calcium channel blocking agent on patients with supraventricular arrhythmia during the postoperative period.

MATERIALS AND METHODS

16 patients who had undergone coronary artery bypass surgery, and had developed supraventricular arrhythmia in our clinic were chosen for this study. All the patients were in sinus rhythm preoperatively. Their mean age was 62.4 with a range of 39-73 years. The operations were carried out under the same protocol in all of the patients. Following the induction of anesthesia, a Swan Ganz catheter was placed through the right internal jugular vein. Aortic and bicaval

cannulation was performed in all of the patients, and moderate hypothermia was achieved. Cardiac arrest was achieved with 4 °C blood cardioplegia, and the heart was cooled topically with slush ice. Myocardial temperature was followed on line continuously with an epicardial probe.

The left internal mammarian artery and reversed saphenous vein grafts were used for revascularization in all of the patients. The mean number of coronary arteries bypassed was 3.7 ranging between 1-6. After the distal anastomoses were completed, the aortic cross clamp was removed, the heart was defibrillated and the proximal anastomoses were made. After the patients were warmed to normal body temperature, and adequate cardiac performance was achieved, the patients were weaned from cardiopulmonary bypass and the cannulas were removed.

All of the patients were in sinus rhythm after the operation, and were stable hemodynamically. Six patients required low dose positive inotropic support and vasodilator agents during the postoperative period. Patients were followed postoperatively in the inensive care unit with continuos electrocardiography, invasive blood pressure (BP), pulmonary artery pressure (PAP), central venous pressure (CVP), cardiac index (CI), pulmonary vascular resistance (PVR), systemic vascular resistance (SVR).

Supraventricular arrhythmia occurred between the postoperative 1st and 72 nd hours. 12 patients had atrial fibrillation, and 4 patients had supraventricular tachycardia as the prevalent arrhythmia. Arrhythmia occurring after the 72 nd hours were excluded from the study because of incomplete hemodynamic monitoring due to removal of the pulmonary artery catheter. Immediately after the arrhythmia was observed, hemodynamic measurements (BP, PAP, CI, PVR, SVR) were made and 25 mg of diltiazem was infused in 30 ml saline in 30 minutes. The same hemodynamic measurements were made on the 15 th minute, at the end of the infusion and 15 minutes after the infusion with a total of 4 measurements.

RESULTS

Hemodynamic responses to diltiazem infusion is summarized in Table 1. The heart rate of patients with supraventricular tachycardia was 142±7 with a range of 132-157. The mean heart rate decreased to 97±4.3 with diltiazem infusion (Fig.1). The mean heart rate of patients with atrial fibrilation was 145±18.8 (90-187). With diltiazem infusion 3 patients returned to sinus rhythm (%25). The remaining 9 patients had a decrease in heart rate to a mean of 93±9.1. The CI values increased significantly in 10 patients. Additionally 4 patients had in significant increases and 2 patients had significant decreases of CI. The most dramatic increase, reaching up to a 50% increase in CI was noted in a patient who had sustained atrial fibrillation with a ventricular rate of 175, and who had returned to sinus rhythm follow diltiazem administration. The overall measurements in all of the patients showed a

Table 1. Hemodynamic responses to diltiazem infusion

Mean	at start	15 minutes(mid)	30 minutes (end)	45 minutes
Heart Rate	144/min	129/min	114/min	94/min
Systolic BP	113.02mmHg	107.68mmHg	104.04mmHg	105.81mmHg
PCWP	19.3mmHg	17.4mmHg	14.3mmHg	14.0mmHg
CI	2.51lt/min.m2	2.66lit/min.m2	2.69lt/min.m2	3.14lt/min.m2
SVR	1352.12 dyn.sec/cm5	1296.12 dyn.sec/cm5	1164.87 dyn.sec/cm5	1074.87 dyn.sec/cm5
PVR	234.56 dyn.sec/cm5	218.94 dyn.sec/cm5	197.58 dyn.sec/cm5	181.13 dyn.sec/cm5

BP-blood pressure, PCWP-pulmonary capillary wedge pressure, CI-cardiac index, SVR-systemic vascular resistance, PVR-pulmonary vascular resistance.

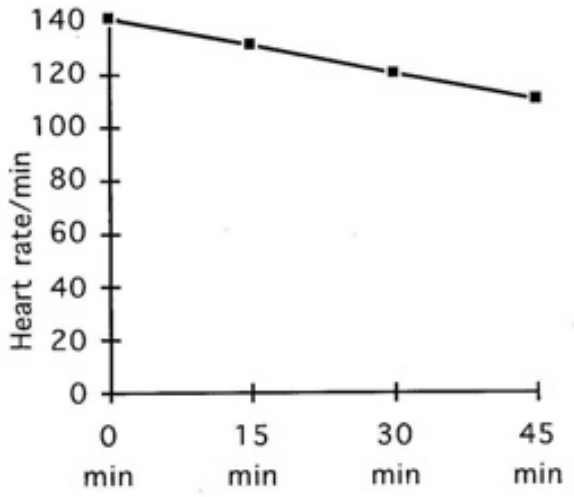


Figure 1: Changes in heart rate were significant at 45 minutes compared to the heart rate at the start of the infusion.

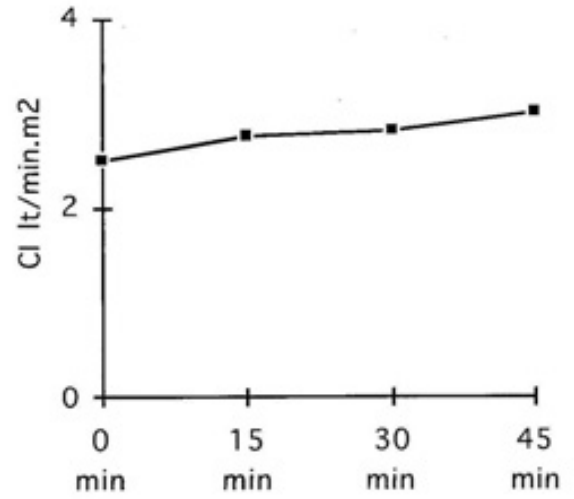
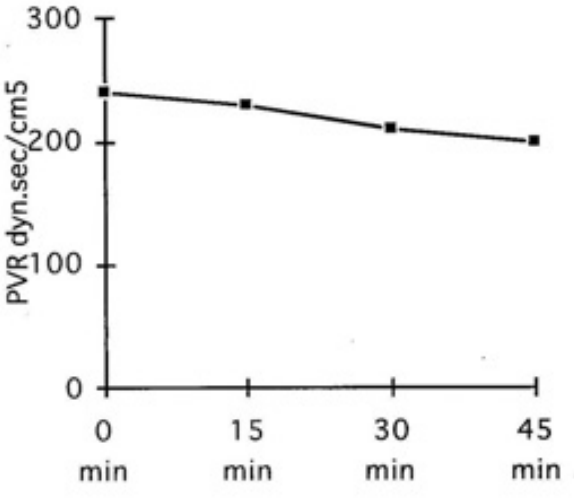


Figure 2: Changes in Cardiac Index were significant at 45 minutes compared to the values at the start of the infusion.



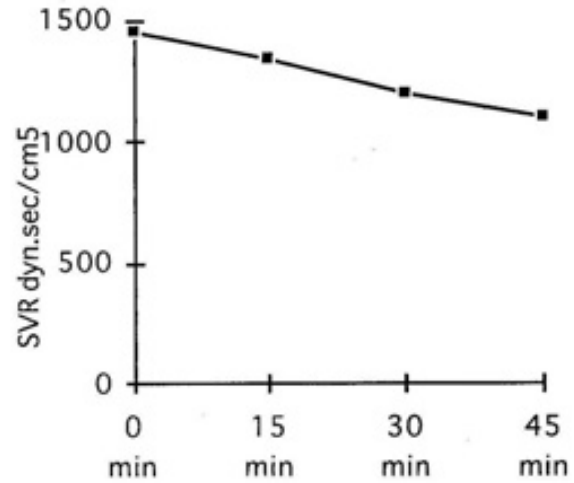


Figure 3: Changes in SVR and PVR were significant at 45 minutes compared to the values at the start of the infusion.

significant increase in these parameters (Fig.2). The BP and PCWP values showed a mild decrease in most of the patients, but this decrease was statistically insignificant. Patients in atrial fibrillation who had returned to sinus rhythm showed an increase in BP but this was also statistically insignificant. PVR and SVR values decreased significantly in all of the patients studied (Fig.3).

DISCUSSION

Supraventricular arrhythmia occurring during the postoperative period in cardiac surgery can cause a decrease in cardiac output between 10 and 30% [1]. For this reason sinus rhythm during early postoperative period is ideal. Atrial fibrillation is seen in 25-50% of patients after coronary bypass operations [1-3]. These arrhythmia are very rarely a cause of morbidity and mortality [1-2]. However, they

can frequently complicate the postoperative period [1]. Elderly patients, especially those with multiple organ dysfunction such as chronic obstructive lung disease or chronic renal insufficiency, are more prone to these arrhythmia [1-2]. For this reason, immediate therapeutic intervention should be carried out in these patients in whom serious problems can be caused by such arrhythmia. In our study group elderly patients constitute most of the patients with 8 patients over 60 years of age, and only one patient 39 years old. All of the patients in the study group had mild preoperative obstructive pulmonary functions.

These types of arrhythmia are generally treated with digitalis, calcium channel blockers or a combination of these [1,2,4]. Digitalis is the first choice of treatment in these arrhythmia, and only patients refractory to digitalis treatment were chosen for the study, and were additionaly treated with diltiazem. Diltiazem has proved to be very useful in terminating atrial fibrillation and restoration of sinus rhythm, and it is especially effective in treating supraventricular tachycardias by depressing atrioventricular conduction, and increasing the atrioventricular refractory period [5]. It has been reported that diltiazem has controlled the ventricular rate rapidly, has returned 75% of the patients with paroxysmal atrial tachycardia to sinus rhythm and has restored sinus rhythm in 17% of patients with atrial fibrillation [4-7]. Our study has also shown that all 4 patients with paroxismal atrial tachycardia had returned to sinus rhythm, and 25% of patients with atrial fibrillation had sinus rhythm reestablished. All of the studies on diltiazem have stressed that diltiazem causes hypotension because of it's periferic vasodilator effect. While this effect is statistically important, it is clinically insignificant and returns to normal 20 minutes after the infusion [2,4-7]. This effect was seen in studies in which diltiazem was given in bolus, or in 5 minute infusions which is very rapid compared to our study protocol [4-6]. In our patients hypotension was observed in a limited number of patients, and was statistically insignificant. Some patients in whom the sinus rhythm was reinstated, blood pressure even showed mild increases. We believe the decreased hypontensive response in our patients was due to our longer infusion times. In the literature we have surveyed, hemodynamic responses to diltiazem was only examined with blood pressure monitoring. This is the first study on the hemodynamic effects of diltiazem in a postoperative early period setting of cardiac surgery patients, and the first study to record the hemodynamic responses with measurements of CI, PCWP, PAP, LVSWI, PVR, SVR in addition to BP and HR. We have observed that while PAP, PVR and SVR decreases significantly, CI and LVSWI increases. These hemodynamic changes are especially important in the early postoperative period. It is also stressed that, especially in patients with decreased cardiac outputs declines in PVR and SVR reaching up to 10% of normal values is essential in the postoperative care [1]. It is also emphasized that these decreases in resistance are among the beneficial effects of diltiazem in increasing cardiac output in addition to it's antiarrhythmic effect [1]. We have seen these beneficial effects of diltiazem in our patients with the expected decreases in the resistance and increases in cardiac output. We have also observed that diltiazem is also very potent in it's ability to reverse supraventricular arrhythmia.

We believe that in a postoperative cardiac patient, supraventricular tachyarrhythmias can be a very important cause of mortality and morbidity, and diltiazem is an ideal drug of choice in these patients because of it's beneficial effect on cardiac out put due to it's effect on vascular resistance and proven antiarrhythmic efficacy.

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