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CLINICAL CIRCULATION IV

A89

TITLE: ABSENCE OF HEART RATE VARIABILITY IN ESOPHAGECTOMIED PATIENTS: PROBABILITY OF AUTONOMIC DENERVATION OF THE HEART

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Analysis of heart rate variability (HRV) has been employed as a non-invasive measure of autonomic nervous system (ANS) function.[1] Esophagectomy with lymph node dissection in the neck, thorax and abdomen causes sustained tachycardia postoperatively. The cause of this phenomenon might be due to autonomic denervation of the heart arising from surgical intervention. This study was, therefore, undertaken to determine whether HRV decreased following esophagectomy with lymph node dissection perioperatively.

With informed consent and institutional approval, we studied 7 patients with esophageal cancer who underwent esophageal resection. Consecutive 600 RR intervals were measured on the preoperative day as control and 1, 3, 5, 7 and 14 POD. Heart rate (HR) data were calculated every 0.5 sec (a total of 512 times) by the method of integral pulse-frequency modulation, which used a low-pass digital filter with a cut off frequency of 0.5 Hz.[2] Power spectral density of these data was computed by using a fast Fourier transform. The areas of the spectral peaks within each measurement were calculated as follows: low- (LO, 0.04-0.09 Hz), mid- (MI, 0.09-0.15 Hz), and high-frequency areas (HI, 0.15-0.5 Hz).

As shown in table 1, LO and MI decreased significantly on 1, 3 and 7 POD compared with control. HI and sum of each power had been decreased until 14 POD. HR was increased to 75 bpm from 100 bpm and sustained tachycardia persisted until 14 POD.

Postoperative tachycardia and depression of HI suggested severe depression of the cardiac vagal branch compared with the cardiac sympathetic branch due to surgery. The mechanism of recovery of LO and MI could result from denervation supersensitivity of ANS innervating the heart. Our data suggests that esophagectomy with lymph node dissection may inhibit autonomic nervous control of the heart in postoperative periods, resulting in disturbances of circulatory homeostasis.

Table 1: Changes of power spectral areas

	C	1	3	5	7	14POD
LO	4.4±3.1	0.5±0.3*	1.8±2.1*	2.5±2.7	1.4±2.0*	2.2±2.6
MI	1.2±1.3	0.2±0.2*	0.4±0.6*	0.6±0.7	0.3±0.4*	0.6±0.8
HI	1.6±1.3	0.2±0.2*	0.5±0.6*	0.6±0.7*	0.5±0.5*	0.8±0.5*
T	7.2±3.6	1.0±0.6*	2.6±3.1*	3.7±4.0*	2.1±2.7*	3.5±3.7*
HR	76±16	99±22*	101±20*	97±10*	97±14*	95±10*

Values are mean±SD.
C;control, T;sum of LO, MI and HI, HR; heart rate.
* Statistically different from the control. (P<0.05 by repeated ANOVA)

References:
1. Am J Physiol 248: H151-H153, 1985
2. The study of heart-rate variability, Clarendon Press, 1980, pp 59-77

A90

Title: **RIGHT VENTRICULAR INOTROPIC EFFECT OF ATRIAL PAING AFTER CORONARY ARTERY BYPASS GRAFTING**

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INTRODUCTION: Increasing heart rate (HR) has been shown to enhance in vitro the contractility of myocardial papillary muscle (1). After CABG atrial pacing has benefic effects on cardiac index without deterioration of ejection fraction or metabolic status (2). This could be explained by a rate dependant effect and/or by a direct effect on contractility. In man, myocardial contractility may be appreciated by the slope of the end systolic pressure-volume (ESP/ESV) relationship obtained by changing ventricular loading conditions. It may also be appraised by ventricular dP/dt or dP/Pdt. The aim of this study was to appreciate whether or not atrial pacing might alter right ventricular (RV) contractility after CABG.

PATIENTS AND METHODS: After approval by the ethical committee and informed consent obtained, 15 patients who underwent elective CABG were studied. A rapid response pulmonary artery catheter was inserted preoperatively to measure cardiac output, RV end diastolic volume index (RVEDVI), RV end systolic volume index (RVESVI) and right ventricular ejection fraction (RVEF). Atrial epicardial pacing wires were placed peroperatively on the right atrium. RV contractility was assessed by the slope of the ESP/ESV relationship under acute volume loading realized by means of the inflation of a military anti-shock throuser (MAST). RV dP/dt and dP/Pdt were also determined. Patients with a baseline HR > 85/min were not included in the study as were those treated with inotropes, those suffering from atrial fibrillation or when a tricuspid regurgitation was suspected. Two to 4 hours after the end of surgery, atrial pacing was performed at a rate of 100/min. Measurements were performed before pacing at baseline and after MAST inflation. The mean of five measurements was used to determine RVEF, RV volumes and cardiac index (CI). The same measurements were repeated under pacing. Results were compared by a paired Student t test, a p<0.05 was considered significant.

RESULTS:

	Baseline	Pacing	
HR *(/min)*	73±7	100±1	p<0.001
MAP *(mmHg)*	86±14	91±15	p<0.01
MPAP *(mmHg)*	19±4	21±5	p<0.05
CI *(l/min/m²)*	2.5±0.4	2.7±0.5	p<0.05
δESP/δESVI *(mmHg/ml)*	.06±.46	.83±1.4	p<0.05
dP/dt *(mmHg/s)*	185±53	241±79	p<0.05
dP/Pdt *(/s)*	14±7	20±10	p<0.001
SVI *(ml/b/m²)*	36±8	28±9	p=0.0005
RVEF *(%)*	34±5	28±7	p<0.01
RVEDVI *(ml/m²)*	108±22	101±20	p<0.05
RVEDP *(mmHg)*	11±5	9±5	p=0.0005

DISCUSSION: After CABG, atrial pacing at a rate of 100/min increases right ventricular contractility as appreciated by the end systolic pressure-volume relationship and dP/dt or dP/Pdt. The consequence is a significant increase in cardiac index. RV filling pressure was decreased. This technique might have therapeutic implications for the postoperative management of patients after CABG.

REFERENCES:
1.J Pharmacol Exp Ther 1961;134:376-389
2.Circulation 1981;64 (suppl II):II-48-II-53