Title : EFFECTS OF DOBUTAMINE ON SYSTOLIC AND DIASTOLIC CORONARY BYPASS GRAFT FLOW IN HUMANS

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Introduction: Coronary artery bypass graft surgery (CABG) may lead to postoperative impairment of myocardial function. In this regard, Dobutamine is widely indicated because of its potent and relatively pure inotropic action[1], with an adapted mean coronary blood flow response[2]. Our study was conducted to analyse the mean coronary bypass graft flow (CBGF) and its phasic (i.e. systolic and diastolic) components after an inotropic stimulation induced by Dobutamine (Dob).

Material and methods: 10 patients (57.8 ± 6 yrs SD) were studied six hours after the surgical procedure. Written informed consent was obtained prior to the study and the protocol was approved by the University Human Studies Committee and the National Heart Society. Criteria for inclusion were an angiographically proved proximal left anterior descending coronary artery stenosis over 95 %, a preoperative ejection fraction over 45 % and a post operative hemodynamic stability without vasodilating or inotropic drugs. Anesthesia (High doses of fentanyl), cardiopulmonary bypass management (partial hemodilution, moderate hypothermia, cardioplegic arrest) and saphenous graft bypass were similar for all patients. The following hemodynamic parameters were measured or calculated: heart rate (HR, ECG lead); cardiac index by thermodilution (CI, l/min/m^2), right atrial (RAP), pulmonary artery (PAP) and pulmonary wedge (PWP) pressures via a triple lumen balloon tipped Swan Ganz catheter; systolic (SAP), diastolic (DAP) and mean (MAP) systemic arterial pressure (mmHg) via a radial catheter; coronary driving pressure (CDP) as MAP-RAP in mmHg; systemic vascular resistance index SVRI as the ratio MAP-RAP/CI in IU).

CBGF study: We used laboratory miniaturized implantable flow probes secured by resorbable sutures on the adventitia of the graft at the end of the surgical procedures[3]. Probe was linked to an 8 MHz pulsed Doppler apparatus via leads coming out of the thorax through the skin and was removed 6 days later by traction, without any problem. The apparatus used provided the ability to measure vessel diameter d and mean cross sectional blood flow velocity Vm. Then, CBGF can be calculated as follows : CBGF = $\pi d^2/4.V_m.60$ in ml/min.

Data analysis: Instantaneous flow velocity was recorded at 100 mm/sec paper speed during at least 10 cardiac cycles. After repering systolic and diastolic times using ECG and radial pressure, each beat was digitized using a graphic tablet linked to a microcomputer to obtain systolic (Qs) and diastolic (Qd) coronary bypass graft flows. Coronary bypass graft resistances (CVR) were calculated as the ratio MAP-RAP/Qd in IU.

Protocol: Measurements were performed before (control) and 30 min after infusion of 2 successive doses (5 and 10 µg/kg/min) of Dob (central line). Statistical study was performed using 2 way analysis of variance and Newman-Keuls test.

Results: are summarized on table (mean ± SD).

	Control	5 µg	10 µg	Cvs10	Cvs5	5vs10
CI	2.4 ± .5	2.85 ± .75	3.6 ± 1.1	<.001	NS	<.01
HR	91.4 ± 13.2	95.7 ± 15.5	112.7 ± 14.2	<.001	NS	<.005
SVRI	29.32 ± 7.45	29.07 ± 8.23	25.8 ± 8	<.05	NS	<.025
SAP	108.1 ± 14.5	121.9 ± 13.6	145.5 ± 31.4	<.001	NS	<.01
DAP	61.2 ± 10.7	66.4 ± 7.6	69.6 ± 14.5	<.01	NS	NS
MAP	76.9 ± 11.7	84.9 ± 7	95 ± 18	<.001	NS	<.05
RAP	8.3 ± 2	8.3 ± 2	8.2 ± 4	NS	NS	NS
RPP.10^3	9.8 ± 1.9	11.7 ± 2.4	16.35 ± 3.9	<.001	NS	<.005
CBGF	61.8 ± 60	70.25 ± 64	81.18 ± 68	<.001	NS	<.005
Qs	37.45 ± 50	37.9 ± 52	45.2 ± 63	NS	NS	NS
Qd	75.23 ± 66	83.46 ± 67	102.7 ± 90.9	<.001	NS	<.05
CVR.10^3	2.03 ± 1.83	1.99 ± 1.79	1.62 ± 1.11	NS	NS	NS

3 positive linear correlation were found between :
* Qs and SAP variations : r = 0.57 ; p <.001;
* Qd and RPP variations : r = 0.76 ; p <.001;
* CDP and Qd variations : r = 0.62 ; p <.01, but no statistically significant difference could be noted between the slopes from Control to 5, and from 5 to 10 µg/kg/min.

Discussion: Beyond classical systemic hemodynamic effects of Dob, the main result of this study is the phasic determinants of mean CBGF increase.
1) Qs did not change, despite an increase in myocardial extra vascular forces, because systolic pressure increased (see correlation between SAP and Qs variations).
2) Qd increase was not linked to a primary vasodilating effect of Dob, since the slope of the diastolic pressure-flow relationship remained unchanged. Qd increase was rather a consequence of an increased oxygen demand (see the linear correlation between Qd and RPP variations).
Therefore in these patients, in early post operative period after CABG surgery, Dob resulted in an adequate adaptative response of CBGF. This resulted from :
- a maintained Qs by an increased SAP;
- an increased Qd adapted to the Dob-induced increase in myocardial oxygen demand.
In conclusion, Dob appears to be useful if SAP is maintained and an adequate Qd is possible to be obtained via the correction of the coronary artery stenosis.

References:
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