EFFECTS OF OPEN HEART SURGERY ON THE LEVELS OF ATRIAL NATRIURETIC PEPTIDE (ANP), CORTISOL, AND ALDOSTERONE

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Twentyone patients were selected for determining the effect of open heart surgery on the levels of atrial natriuretic peptide (ANP), cortisol and aldosterone. Their blood samples were taken preoperatively and on postoperative second day, for plasma atrial natriuretic peptide (ANP), cortisol and aldosterone levels. Determined level of plasma ANP was 28.3 ± 5.6 pg/ml preoperatively, 39.2 ± 8.8 pg/ml postoperatively p<0.001. Determined levels of cortisol and aldosterone was 188 ± 9.6 mg/dl 115 ± 28 µg/day preoperatively, and 12.4 ± 3.1 mg/dl 48.7 ± 29.2 µg/day postoperatively (p<0.05. p<0.001). The results showed that after open heart surgery, level of plasma ANP increased, on the other hand level of cortisol and aldosterone decreased.

Key words: Atrial natriuretic peptide, cortisol, aldosterone, open heart surgery.

Plasma ANP is a peptide with 28 aminoacids (AA) which is synthesized, stored and secreted from the cardiac cell [1-3]. What regulates ANP release predominantly in normal subjects is unclear. Kawakami showed that plasma ANP levels are related with left atrial systolic function [21]. Plasma ANP has natriuretic and diuretic effects [2, 3] by inhibiting excretion of renin, aldosterone and vasopressin, [5,6,8] which also relaxes smooth muscles of vessels and decreases blood pressure [4] . It also has an effect on kidneys [1,5,7]. The purpose of this study was to determine the effects of open heart surgery on the level of plasma ANP, cortisol and aldosterone.

Table I. Demographic data of twenty one patients selected for the study.

Age Operation	Weight (kg)	Sex	Preop.Blood Pressure(mmHg)	Postop. Blood Pressure(mmHg)	Surgical Procedure
65	82	M	140/90	120/85	CABG
70	78	M	150/95	130/90	CABG
48	52	F	130/85	110/80	MVR
9	30	F	110/70	100/70	ASD
28	48	F	120/80	120/80	ASD
53	65	M	130/85	130/80	AVR
68	87	M	150/95	140/85	CABG
73	85	F	155/90	155/85	CABG
45	48	F	110/80	110/70	MVR-TP
42	50	F	125/85	110/80	AVR
6	20	M	100/75	100/70	TOF
7	25	M	110/70	100/70	DORV-VSD
13	30	M	115/65	120/65	TOF
5	22	M	110/70	110/70	FONTAN
3	14	M	100/60	115/60	CSD-PFO
14	35	F	120/75	110/70	VSD
68	95	M	140/85	130/80	CABG
12	35	F	130/75	125/70	AS
55	84	M	140/90	140/85	CABG
40	82	M	135/85	120/70	MVR-TP
22	33	M	120/80	120/80	VSD

CABG: Coronary arter bypass grefting, MVR: Mitral valve replacement, ASD: Atrial septal defect, AVR: Aortic valve replacement, TP: Tricuspit annuloplasty, TOF: Tetralogy of fallot, DORV: Double oulet of right ventricle, VSD: Ventriculer septal defect, PFO: Patent foramen ovale, AS: Aortic stenosis.

Table II. Pre and postoperative plasma levels of ANP, cortisol, and aldosterone of the patients and control groups in order to student's t-test.

	Preop	Postop	p<	Control Group
ANP (pg/ml)	28.3 ± 5.6	39.2 ± 8.8	0.001	18.3 ± 11
Cortisol (mg/dl)	188 ± 9.6	12.4 ± 3.1	0.05	5 - 25 *
Aldosterone (μg/day)	115 ± 28	48.7 ± 29.2	0.001	6 - 25 *

$p < 0.001$: Relationship between preoperative patients and control group.
$p < 0.001$: Relationship between postoperative patients and control group.
*: Normal laboratory parameters.

MATERIALS AND METHODS

Twentyone patients were selected for this study. Age ranged between 3 and 73 years (mean 35.5). Weight ranged between, 12-87 years (mean 53.3). Ten normal volunteers were included in this study as a control group (Table I).

Blood samples were drawn in plastic tubes containing edetic acid (EDTA) - 2 Na (1.25 mg/ml blood) and aprotinin (500 ICIV/ml). Preoperative atrial blood samples were taken early in the morning of operation day. Postoperative blood samples were taken from the arterial catheter, on the second day, after the operation. After centrifugation, plasma was taken and stored at -40 °C until assayed.

The measurement of ANP was performed by the procedure described by Hiwada et el [22]. Briefly, plasma extract was reconstituted with assay buffer (0.1 mol/L sodium phosphate buffer [pH 7.4] containing 0.1 % bovine serum albumin, 0.1 % Triten x-100, 0.05 mol/ L NaCl and 0.01 % Na N3). RIA of ANP was performed with a rabbit antiserum to ∞ - human atrial natriuretic peptide (∞ - h ANP) 125 / - ∞ - hANP was used as a tracer. After incubation for forty-eight hours at 4°C, bound and free peptides were separeted by adding bovine X-globulin dissolved in buffer (find concentration 0.8%), and polyethylene gylcal 6000 in water (final concentration 12.0 %) and the pellets were counted with a gamma counter.

The values were expressed as mean ± SD. Standart deviation, coefficient were calculated to evaluate the relantionship between variables. Pre and postoperative levels of ANP, cortisol and aldosteron are shown in Table II.

RESULTS

As shown table II, ANP levels of postoperative patients are higher than the control group. Statistical analysis was performed using student's t - test and the changes with $p < 0.001$ was considered statistically significant. At the same time postoperative cortisol levels were lower than control group $p < 0.05$. These results were considered to be statistically significant. Postoperative aldosterone levels were lower than preoperative aldosterone levels too, $p < 0.001$, and it was considered statistically significant.

DISCUSSION

There is a variety of different reasons and mechanisms that elevates plazma ANP levels. ANP is secreted in response to stimuli that induce atrial wall tension[10,11], or increase in the frequancy of atrial contraction[21]. In humans, except operations, plasma ANP levels are elevated in chronic renal failure[14], congestive heart failure[13], hypertension[12], valvular heart disease[9,15], coronary heart disease[16], and paroxysmal supraventricular tachycardia[17].

Our study showed that, plasma ANP levels were increased as emphasized in literature[18-20], cortisol and aldosterone levels were decreased in open heart surgery.

We know that increased plasma ANP levels inhibits the secretion of aldosterone. Our experiments reveal the same results. The relationship between increased level of plasma ANP and decreased level of cortisol is unclear, but our results were similar with the literature.

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