

ANTHROPOMETRIC AND BIOCHEMICAL CHARACTERISTICS OF PATIENTS UNDERGOING ELECTIVE CARDIAC SURGERY

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ABSTRACT

Objective: To determine anthropometric profile and hematological characteristics of patients for elective cardiac surgery.

Materials and Methods: The study was conducted in Iran, during June- November 2006, on 252 patients undergoing elective CABG and valve surgery (VS) and 131 normal subject age and sex matched without clinical evidence of any disease. Data about family background, personal information, anthropometric parameters, hematological and biochemical examination were obtained.

Results: Weight, shoulder width, waist circumference, hip circumference, mid upper arm circumference of patients for CABG were similar to those of normal while fat fold at triceps and biceps were significantly higher. However, values obtained from VS patients were significantly lower ($P < 0.5$). Mean BMI was highest (28.7 ± 4.575 and 26.5 ± 4.04) for CABG and lowest for VS patients (22.6 ± 4.395 and 23.7 ± 4.114). Percent body fat, waist hip ratio (WHR), shoulder height (S/Ht) ratio, shoulder weight (S/Wt) ratio and waist height (W/Ht) ratio also exhibited similar trend. Mean arm muscle area was lower significantly in cardiac patients as compared to normal. Hematological parameters such as cell count; differential counts were within the normal range in both the groups. Biochemical profile was different wherein CABG patients exhibited hyperglycemia, hypercholesterolemia and hypertriglyceridemia.

Conclusions: Obesity in population was rampant (including normal). WHR was found to be independent risk indicator for coronary artery diseases; other indices that may be indicative are S/Ht and S/Wt ratios. Lipid profile is an important marker since total cholesterol and triglyceride values were significantly higher in CABG than VS patients.

Keywords: CABG, Valve Surgery, Anthropometric profile, S/Ht ratio, BMI, Body Fat%, Serum Lipid Profile

INTRODUCTION

Estimates from WHO and other epidemiological studies suggests CVD to be a killer disease around the world, causing an average death of 17 million, particularly of heart attack and stroke every year.^{1,2} Reduction in the modifiable risk factors such as cigarette smoking and high blood pressure coupled with medical advances has lead to a reduction of its incidences³. Although CVD has been a major threat to public health in affluent countries for decades, age-adjusted mortality from CAD are recently reported to decline. It is now set to become an epidemic in developing countries, and over the next 20 years it is expected to become an important global health problem. Mortality figures for Asian countries show a rising tide for CHD similar to that experienced by industrialized west during 1950s and 1960s^{4,5}.

Drastic changes in eating habits and life style

patterns experienced in Iran population in the past few decades has lead to a rise in mortality and morbidity due to CVD and associated factors^{6,7}. According to Mashhad Medical Science University Statistical unit, mortality due to CVD in the whole province of Khorasan Razavi was 38.9% of the crude deaths between 2003 and 2005⁸. While the statistics from Ministry of health, Treatment and Medical Education provided an average figure for Iran as 45.3% in 2003⁹. Frequency of occurrence of the risk factors for CVD among Iranian population as evidenced by nation wide surveys (in people of 60 years and above) included the following; women with two or more CVD risk factors were 74% compared with 53% in men, 25 and 55% men and women had high serum cholesterol, prevalence of diabetes mellitus was 24 and 29%, 15 and 36% men and women respectively were obese¹⁰. Other features indicative of risk for CVD reported by several studies are high waist -hip ratio; hypertension in people over 20 years of age (4-8% men and women), dyslipidemia (26 and 34% for the two genders), tobacco consumption (21.6%) and lack of

physical activity (87%)¹⁰⁻¹³.

Surgical intervention among the various course of management of CVD is demonstrated to alleviate symptoms and increase life expectancy¹⁴. It is indicated that 75% of patients post surgically are protected against additional ischemic events for 5 years; while 50 and 15% patients are benefited for 10 and 15 years respectively¹⁵⁻¹⁷. Hence it may be relevant to characterize the risk factors in target population so that effective prevention of risk factors is possible. Therefore objectives of the present study were to determine anthropometric profile and biochemical characteristics of patients suggested elective cardiac surgery in Iranian population.

MATERIAL AND METHODS

The study was carried out during June to November 2006 in two hospitals from IRAN (government and private). After receiving approval from Ethical Committee (Mashad Medical University), 1116 patients who were suggested cardiac surgery were contacted and 252 patients both males and females who fitted in to our selection criteria were included for the study. Following were the selection criteria:

Inclusion criteria: men and women aged 30 years and above, those on their first surgical treatment -CABG and Valve Surgery and voluntary willingness to participate in the study.

Exclusion criteria: Patients with complications such as acute respiratory problem, kidney problem, cancer, liver problem, amputation, neuro-psychopathy disease and prior cardiac surgeries, or any other surgeries conducted within 6 months, patients on cortisone treatment were not included.

Anthropometric assessment: Height was measured using a standard height measuring scale; weight was measured using a digital balance (Seca770). MUAC, Hip and Waist circumferences and shoulder width were measured using nonflexible fiber glace tape to the nearest of 0.1 cm. Skin fold at biceps and triceps were measured using skin fold caliper (CaliperC-120 make USA). Standard methods as described by Jelliffe (1966)¹⁸ were adopted. A group of 131 subjects (Female and male) age and sex matched, who did not have any history of metabolic disorders and were otherwise healthy were included for comparison as normal for anthropometric assessment.

Biochemical assessments: A detailed blood investigation was carried out i.e. Cell count (W.B.C and R.B.C), differential count, HB, HCT was assessed using standard techniques. Blood lipid profile (HDL-C, LDL-C, TG and total cholesterol) was also investigated. Other examinations included were blood urea, creatinin,

GENERAL PROFILE OF SUBJECTS INCLUDED FOR THE STUDY

Parameter		Variables	Valve Surgery N= 33	CABG N= 219
Prevalence %		Males	54.5	66.2
		Females	45.5	33.8
Age (Yrs)		Males	44.9 ± 16.59	62.0 + 8.94
		Females	48.1 ± 11.38	58.3 + 10.38
Marital status %		Married	87.9	90.9
		Un married	12.1	1.2
		Widow	0.0	7.9
Living arrangement %		Spouse	30.3	53.2
		Children	3.0	6.9
		Alone	0	4.4
		Relatives	6.1	2.8
		Spouse & children	60.6	33.0
No of children %	0-2	Males	31.3	15.9
		Females	36.8	6.9
	3-4	Males	31.3	33.3
		Females	21.1	26.4
	5->	Males	37.5	50.8
		Females	42.1	66.7

Table 1

serum NA, K, total protein, albumin, transferrin and fasting blood glucose. These analyses were done using automatic analyzer system (model: Liasys, AMS, Italy).

General information: Information about marital status, education, employment, economic status and living arrangements of the selected patients was obtained using a structured self-reporting questionnaire.

Each selected participant was subjected to the proposed investigations one week before surgery. The data was analyzed for statistics using SPSS; t test and analysis of variance were used for comparing the means. Tukey's method for significance was employed.

RESULTS

It is evident from our results that the probable incidence of elective surgical intervention in patients without complications from the selected Iran province to be 22.5% during the study period. A perusal of table1 suggests that out of 252 cases included for the study, 13.1 percent had valve surgery (VS) while 86.9 percent had CABG.

The demographic details of the selected

patients is presented in table 1, it can be seen that mean age of subjects in the two surgical interventions i.e., CABG and VS were different, patients for VS were younger being 37-59 years (48.1 11.38 and 44.9 16.59 for male and female) while patient for CABG were considerably older with a mean age of 58.3 10.38 and 62.0 8.945 years for females and males respectively. Differences in age of both males and females for the two treatments were significant at 5 percent level. Eighty-eight to ninety-eight percent of patients for VS and CABG were married. The living arrangement of patients indicated marked differences, majority of patients with VS lived with their families comprising of spouse and children. On the other hand patients for CABG, a higher percentage lived alone or with their spouse. The difference in living pattern among patients for the two interventions could be the age factor, patient for CABG being older; children may have been independent and separated. Variables such as employment and education status exhibited small differences among subjects undergoing CABG and VS procedures (table 2). Anthropometric measurements of subjects for elective cardiac surgery and normal subjects are presented in table

EDUCATIONAL AND OCCUPATIONAL STATUS OF THE SELECTED SUBJECTS

Parameter	Variables	Gender	Valve Surgery	CABG
Employment %	Officer	Male	56.3	31.3
		Female	5.3	16.7
	Laborer	Male	6.3	19.1
		Female	0	2.8
	Housewife	Female	73.3	70.8
	Farmer	Male	0	18.3
		Female	10.4	2.8
	Business	Male	18.8	29.8
		Female	0	6.9
	Others	Male	0	1.5
Female		10.5	0	
Education %	Illiterate	Male	12.5	21.2
		Female	21.1	46.5
	Primary	Male	18.8	35.6
		Female	26.3	26.8
	High school	Male	18.8	16.7
		Female	26.3	15.5
	PUC/Diploma	Male	25.0	16.7
		Female	26.3	11.3
	Graduates	Male	25.0	9.8
		Female	-	-

Table 2

3 (age and sex matched subjects without clinical evidence of any disease). It is interesting to note that certain body measurements of the CVD patients deviated significantly from those of normal subjects. Mean body weight of subjects for CABG was similar to those of normal while patients for VS were lighter; the differences in weights were significant statistically ($P < 0.05$).

Mean height and shoulder width in all the three groups were essentially similar. Noticeable differences were seen in waist circumference and skin fold thickness at triceps and biceps. Mean shoulder width indicated a small difference among the three groups which was statistically not significant, wherein both male and female patients for CABG had higher values. Waist circumference was also recorded highest for CABG patients. Hip circumference and MUAC values were lower in case of VS; MUAC was markedly lower in case of females ($P < 0.5$). It is also evident from table 3 that skin fold measurements both at biceps and triceps were significantly higher for CABG patients as compared to normal and VS. It was interesting however to note that triceps measurement for VS were moderately higher than normal thereby occupied the middle position; between CABG and normal. It is note worthy that all parameters except for skin fold at triceps were lower in VS patient than those in normal and CABG subjects (table 4).

Application of anthropometric indices for

assessment of nutritional status has been used by many investigators and demonstrated their association to a variety of health problems¹⁹⁻²². Therefore it was proposed to compare a few selected indices in order to identify those indicative of CVD risk.

Significance was tested at 5% level, Means followed by different superscripts in a row are significantly different and those means followed by same superscripts or not different statistically.

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It can be seen from table 4 that WHR of CABG patients was significantly higher than those of VS patients and also the normal participants suggesting WHR independently can be used as risk indicator. BMI, % body fat, shoulder height (S/ht) ratio and waist height ratio were also higher for CABG than the other groups, but were statistically not significant ($P < 0.05$). Nevertheless body fat in case of women for CABG was significantly higher. On contrary to all the indices, MAMC values were considerably lower in both the groups than that for normal. Body surface area (BSA) was compared to identify the differences in the three groups included for this investigation, BSA in both male and female for CABG and VS were essentially

COMPARISON OF SELECTED ANTHROPOMETRIC PARAMETERS AMONG THE CABG, VS AND NORMAL SUBJECTS

Parameter	Gender	CABG Mean ± SD	Valve Surgery Mean ± SD	Normal Mean ± SD	F values
Weight Kg	Males	69.5 ± 11.084 ^a	60.05 ± 13.285 ^b	66.32 ± 10.406 ^a	5.447
	Females	72.89 ± 11.875 ^a	67.76 ± 11.384 ^a	73.60 ± 12.748 ^a	1.443
Height Cms	Males	155.98 ± 6.776 ^a	163.05 ± 8.462 ^b	157.78 ± 5.874 ^a	8.176
	Females	166.21 ± 6.611 ^a	169.46 ± 10.377 ^a	169.56 ± 6.602 ^a	5.470
Shoulder width Cms	Males	40.11 ± 3.594 ^a	38.65 ± 2.368 ^a	39.40 ± 2.545 ^a	1.887
	Females	44.66 ± 3.258 ^a	44.30 ± 3.927 ^a	43.04 ± 4.157 ^a	3.930
Waist Circumference.Cms	Males	100.56 ± 11.610 ^a	84.94 ± 14.485 ^b	96.05 ± 11.483 ^a	12.055
	Females	98.02 ± 11.712 ^a	90.56 ± 9.652 ^b	93.87 ± 10.286 ^{ab}	4.671
Hip Circumference.	Males	103.36 ± 8.845 ^a	93.34 ± 13.441 ^b	103.68 ± 9.508 ^a	8.927
	Females	98.77 ± 8.111 ^{ab}	95.60 ± 6.769 ^a	100.30 ± 7.870 ^b	2.360
MUAC Cms	Males	30.01 ± 3.515 ^a	27.12 ± 4.726 ^b	30.27 ± 3.706 ^a	5.443
	Females	29.71 ± 3.529 ^a	28.84 ± 3.912 ^a	29.97 ± 3.567 ^a	0.633
Triceps Skin fold mm	Males	21.65 ± 5.804 ^b	14.10 ± 4.503 ^a	12.25 ± 2.376 ^a	67.622
	Females	15.51 ± 5.321 ^b	11.03 ± 3.372 ^a	9.82 ± 3.284 ^a	33.486
Biceps Skin fold mm	Males	12.69 ± 4.658 ^b	7.20 ± 3.172 ^a	7.49 ± 2.025 ^a	36.354
	Females	9.34 ± 4.206 ^b	5.50 ± 1.762 ^a	5.68 ± 2.575 ^a	24.802

Table 3

similar to those of the normal.

It is an established fact that pre operative biochemical parameters and hematological details are essential to plan and monitor the surgical conditions. With the interest to identify patient's conditions prior to surgery, details of certain important blood parameters were assessed. Hematological parameter and serum components such as serum lipid profile, selected serum protein fractions, fasting blood sugar, blood sodium, potassium, urea and creatinine are presented in tables 5 and 6. Available knowledge indicates a considerable change in blood concentrations of the certain components during the post surgical period. It is evident from table 4 that the profile of all the selected parameters remained essentially similar in both the groups, i.e., CABG and VS except for hemoglobin and neutrophil count. Comparing to standard values the WBC and RBC count were in the normal range. Hemoglobin was also normal except that a small decrease noted in VS subjects. This could have influenced hematocrit values (HCT), there by HCT values for VS were lower but not statistically significant ($P < 0.05$). Neutrophil and lymphocyte counts indicated differences; neutrophils were significantly lower in VS while lymphocyte was higher.

It is evident that the two intervention groups had considerable differences in certain parameters; CABG patients exhibited hyperglycemia while patients for VS had a mean

glucose level of 65.3 ± 20.75 suggestive of hypoglycemia. Blood values for nitrogen component, cationic (Na, K) levels, transferrin and total albumin remained within normal levels. The lipid profile between the two groups varied significantly, all the parameters in VS patients were within normal range while patients with CABG recorded significantly ($P < 0.5$) higher values. The total serum protein in VS was also significantly lower as compared to CABG, which was in normal levels.

DISCUSSION

CAD has become an epidemic of the present time and is single most important disease affecting morbidity and mortality in populations. Several reports on CAD and its relative influence indicate the enormous impact on quality of life in subjects inflicted^{10,15}. Its prevalence and population characteristics help in prediction of future events and also to develop preventive measures. In the present study we assessed the anthropometric profile of subjects who are in their severity of the disease and required surgical intervention. Simple measurements such as weight for height, skin fold thickness, waist and hip circumferences, shoulder width have frequently used as correlates to the occurrence of the disease^{10, 27}. Our study revealed that a higher percentage of men (63.4%) than women (36.6%) were inflicted with CAD and were for elective surgery. These observations are similar

COMPARISON OF SELECTED ANTHROPOMETRICS INDICES AMONG SUBJECTS FOR ELECTIVE SURGERY AND NORMAL

Variable	Gender	CABG Mean \pm SD	Valve Surgery Mean \pm SD	Normal Mean \pm SD	F values
BMI	Female	28.69 \pm 4.575 ^b	22.58 \pm 4.395 ^a	26.68 \pm 4.185 ^b	14.820
	Male	26.50 \pm 4.040 ^a	23.73 \pm 4.114 ^b	25.62 \pm 4.386 ^{ab}	3.271
%BF	Female	43.16 \pm 6.138 ^c	32.03 \pm 7.708 ^a	38.34 \pm 5.924 ^b	25.454
	Male	39.67 \pm 5.219 ^a	34.19 \pm 5.545 ^b	37.47 \pm 6.061 ^a	8.051
MAMC	Female	23.21 \pm 2.879 ^a	22.69 \pm 4.481 ^a	26.43 \pm 3.503 ^b	15.396
	Male	24.60 \pm 4.755 ^a	25.37 \pm 3.711 ^a	26.89 \pm 3.128 ^a	6.163
WHR	Female	0.973 \pm 0.077 ^a	0.909 \pm 0.081 ^b	0.926 \pm 0.065 ^b	8.195
	Male	0.992 \pm 0.087 ^a	0.946 \pm 0.062 ^{ab}	0.935 \pm 0.069 ^b	10.755
S/Ht	Female	0.256 \pm 0.021 ^a	0.236 \pm 0.013 ^b	0.250 \pm 0.017 ^a	7.677
	Male	0.270 \pm 0.021 ^a	0.261 \pm 0.20 ^{ab}	0.254 \pm 0.24 ^b	9.825
S/Wt	Female	0.595 \pm 0.079 ^a	0.670 \pm 0.146 ^b	0.604 \pm 0.074 ^a	5.082
	Male	0.628 \pm 0.089 ^{ab}	0.670 \pm 0.132 ^a	0.598 \pm 0.97 ^b	4.068
Waist/Ht	Female	0.644 \pm 0.078 ^a	0.524 \pm 0.089 ^b	0.609 \pm 0.078 ^a	15.070
	Male	0.592 \pm 0.075 ^a	0.536 \pm 0.069 ^b	0.554 \pm 0.064 ^{ab}	7.559
BSA	Female	1.51 \pm 0.269 ^a	1.36 \pm 0.339 ^a	1.45 \pm 0.309 ^a	2.248
	Male	1.73 \pm 0.326 ^a	1.59 \pm 0.311 ^a	1.69 \pm 0.309 ^a	1.241

Table 4

to that reported by Fitzgibbon et al²³ and Nazari et al²⁴, according to them male to female ratio was 5.45 in patients with out any risk factors. Over weight and obesity was highly prevalent in the selected population especially those with CABG, this is also supported by other studies^{23,25,26}. It is established that obesity is a risk factor for CVD, nevertheless obesity also leads to poor quality of life and also delayed prognosis²⁵. It is note worthy that over weight and obesity was found rampant in the subjects included for the study, BMI for normal individual was 26.68 ± 4.185 , 25.62 ± 4.386 for men and women and those inflicted with CAD had 28.69 ± 4.575 , 26.50 ± 4.040 . Contrary to this subjects on VS had BMI within normal range 22.58 ± 4.395 (men) and 23.73 ± 4.114 (women).

Waist circumference was found to be the second most sensitive parameter indicative of risk. A typical sex differences in body measurements were evident from the anthropometric measurements. Ranucc et.al²⁶ reported associations between gender, body surface area and obesity, and speculated that body weight on either extremes of the scale give rise to operative or postoperative complications. W/Ht ratio was higher in both males and females for CABG, while S/Ht ratio and S/Wt ratio were significantly higher among male patients for CABG. The observation suggests that the respective indices (S/Ht, S/Wt and W/Ht ratios) for men and women may be indicative of risk. However, a rampant prevalence of over weight and obesity in the study population

may have reduced the efficacy of certain parameters indicative of CAD risk, such as S/Wt ratio, which is considered to be sensitive risk indicator in other studies. Our study exhibited a small difference in S/Wt ratio except in females, therefore fails to be a sensitive indicator. It may be assumed that BSA of CABG and VS patients being same as that of normal may not impose risk for complication during and post surgery in the group studied.

A small but significant differences ($p < 0.5$) were noted in blood parameters, Patients for Vs exhibited significantly low neutrophils and higher lymphocyte counts than those for CABG. Patients for CABG those participated in the study exhibited hyperglycemia (128.4 ± 71.62 mg/dl), literature indicate that Hyperglycemia increased in CABG with increase in age¹¹. This together with high levels of TG, LDL and moderately higher cholesterol signify the risk for CVD, however this gets confounded in presence of over weight and obesity. High BMI per se, WHR > 0.85 along with IGT/ hyperglycemia and high LDL/TG are undoubted characterizes risk for cardio vascular disease. On the other hand in patient with VS, all the parameters were very different from those of CABG.

CONCLUSION

It may be concluded that anthropometric measurements among patients for CABG were markedly higher. WHR was found to be independent risk indicator for CAD followed by

COMPLETE BLOOD CELL PROFILE IN PATIENTS FOR ELECTIVE CARDIAC SURGERY

Constituents	Standard Values	Procedures	Mean± SD	't' value	Significance e*
WBC T/cmm	6.22 ± 1.838	CABG	6.16 ± 1.86	-1.163	ns
		Valve Surgery.	6.5 ± 1.3		
RBC M/cmm	4.7 ± 0.567	CABG	4.7 ± 0.569	0.007	ns
		Valve Surgery	4.7 ± 0.570		
HB g%	13.9 ± 1.646	CABG	14.04 ± 1.65	1.910	*
		Valve Surgery	13.3 ± 1.539		
Hct %	41.6 ± 5.039	CABG	41.8 ± 5.235	0.993	ns
		Valve Surgery	40.6 ± 3.585		
Neutrophils %	60.1 ± 12.05	CABG	60.7 ± 11.866	0.866	*
		Valve Surgery	57.3 ± 14.175		
Lymphocytes %	35.9 ± 10.81	CABG	35.2 ± 10.526	-1.526	*
		Valve Surgery	40.5 ± 13.349		
Others %	2.23 ± 1.497	CABG	2.26 ± 1.523	0.653	ns
		Valve Surgery	1.75 ± 1.258		

* Significant at 5% level, ns: not significant

Table 5

BLOOD PROFILE FOR LIPIDS, NITROGEN COMPONENTS, PROTEIN FRACTIONS AND FASTING SUGAR IN PATINTS FOR ELECTIVE CARDIAC SURGERY

Parameter	CABG Mean ± SD	Valve Surgery Mean ± SD	t' values	Significance*
Fasting sugar mg/dl	128.4 ± 71.62	65.3 ± 20.75	5.526	*
Urea mg/dl	31.86 ± 9.24	32.56 ± 9.24	0.309	ns
Creatinine mg/dl	0.97 ± 0.282	0.99 ± 0.409	0.989	ns
Sodium Eq/dl	141.56 ± 3.95	140.16 ± 3.55	1.986	*
Potassium Eq/dl	4.40 ± 0.43	4.37 ± 0.37	0.389	ns
Cholesterol mg/dl	189.61 ± 43.06	158.23 ± 28.19	5.503	*
Triglyceride mg/dl	199.41 ± 105.5	135.97 ± 46.91	5.720	*
HDL-c Mg/DL	49.95 ± 13.02	44.35 ± 7.89	3.421	*
LDL-c mg/dl	100.98 ± 37.97	84.85 ± 7.89	2.731	*
Transferrin	250.84 ± 47.37	243.03 ± 36.34	0.886	ns
Albumin g/dl	4.44 ± 0.44	4.41 ± 0.482	0.409	ns
Total Protein g/dl	7.21 ± 0.58	6.82 ± 0.55	3.704	*

* Significant at 5% level, ns: not significant

Table 6

S/Ht and S/Wt ratio for men. They could be considered as risk factors for preventive measure among Iranian population. Lipid profile was found to be an important marker since total cholesterol and triglyceride values were significantly higher in CABG than VS patients. A rampant prevalence of obesity in the population may have reduced the efficacy of certain parameters indicative of CAD risk, such as S/Wt ratio. It is also clear that BSA being same as that of normal subjects may not impose post surgical risk in the group studied.

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