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Kathmandu, Nepal

SOUVENIR

(Special Issue)

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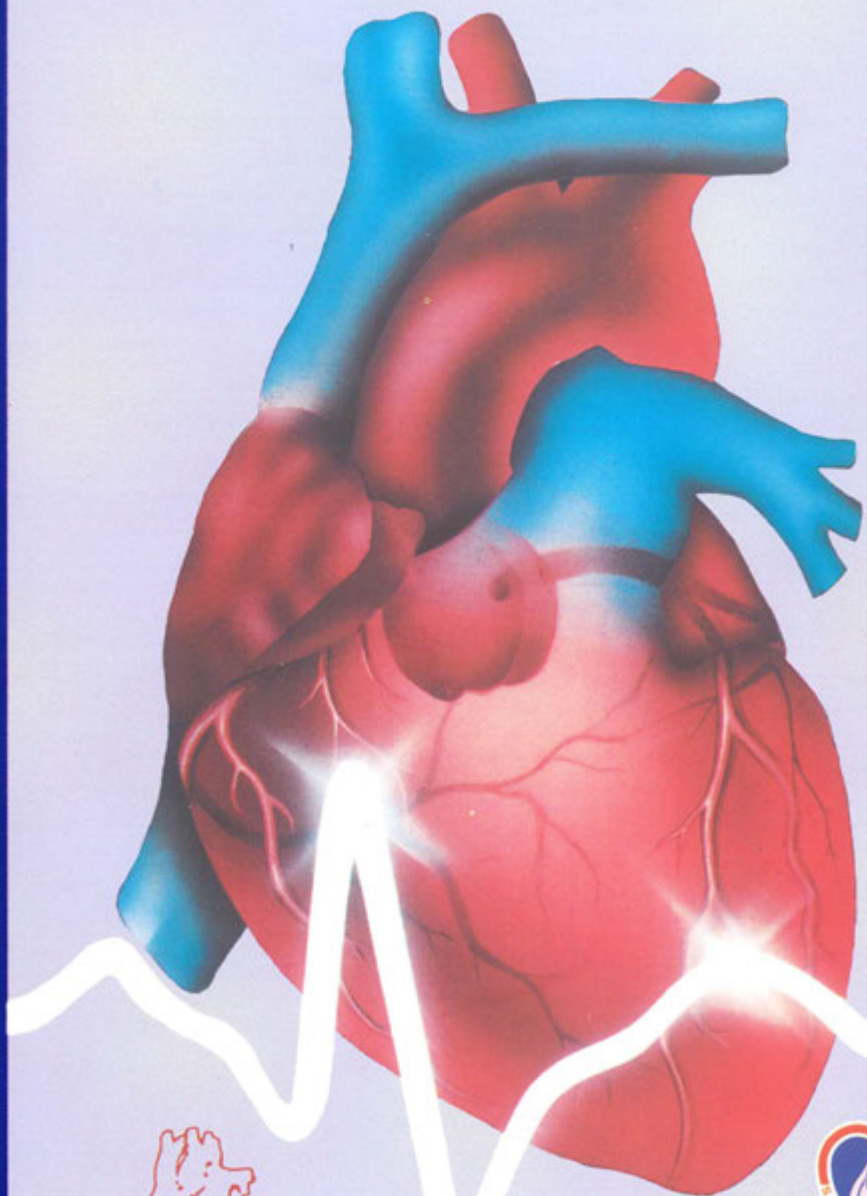
NEPALESE HEART JOURNAL



Cardiac Society of Nepal

SAARC Cardiac Society

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2nd Joint Conference of SAARC Cardiac Society and Cardiac Society of Nepal

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SOUVENIR

(Special Issue)

(Includes special material on Preventing Coronary Heart Disease in South Asia-by Dr. Sania Nishtar)

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Editorial

It is unfortunate that developing countries are fighting with both communicable and non-communicable diseases in large scales at the same time. Health problems are more complex as compared with the developed world. Poverty, population growth, lack of resources, low literacy rates, lack of trained manpower and basic health facilities at remote areas are making things more complicated. Still half of the total annual deaths in developing world are caused by communicable diseases. On the other hand, non-communicable diseases are rising at an alarming rate. Cardiovascular diseases are top killers among non-communicable diseases. Rheumatic heart disease is already considered the disease of the poor. Its incidence and prevalance rates have not decreased significantly despite economic development and improved health facilities in our part of the world. On the contrary, Incidence of diseases like coronary artery disease, Hypertension. Stroke, which were once considered to be the problem of only developed countries has increased sharply. Infact recent dates are suggesting that there is an ongoing epidemic of coronary artery disease in the urban population of South Asia. This is mainly due to inappropriate life style, bad-eating habits, stressful and competitive life, increased tobacco consumption and genetic suseptibility.

We are fighting these problems under the leadership of developed countries. Their research, experience and guidelines are dictating us. But this will help to solve our problems only partly. Because our situation is different, social structure is different and we are genitically different. There is lack of resources. We can not afford expensive treatment modalities and technology. That's why we need to cooperate and work together to develop more suitable strategies to fight these diseases, both in the fields of prevention and cure.

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Coronary Artery Disease: An emerging epidemic in Nepal

Dr. Arun Maskey, Prof. Arun Sayami, Dr. Mrigendra Raj Pandey

Key words:
Coronary Artery Disease (CAD), Acute Myocardial Infarction (AMI), Epidemic.

Introduction:

Cardiovascular diseases (CVD) accounts for approximately 12 millions deaths annually and is the commonest cause of death globally. CVD is also the major contributor to the burden of premature morbidity and mortality and accounted for 85 millions disability adjusted (DALYs) life years in 1990[1]. It has been estimated that during the 25 years period from 1965-1990 mortality from coronary artery diseases (CAD) fell by 50% in Australia, Canada, France &US and 60% in Japan and Finland[2]. The identification of major risk factors and effective control of them through population-based strategies of prevention were mainly responsible for this decline. The rise and subsequent decline in CAD epidemic in almost all industrialized countries in the later half of twentieth century has been well documented, but most of the developing countries are experiencing alarming increase of the disease.

Global Scenario:

CAD shows a declining trend in Western industrialized countries. CAD was a rare cause of death in the US at the turn of the century, accounting for <10% of all deaths in 1910. By 1965, the CAD mortality rate in US[3] increased more than five fold to 55% of all deaths, with only Finland having higher rate, which was followed by sharp decline during the 25 years period from1965-1990[1]. Over the past three decades, the annual decline of CAD was 0.6% for prevalence, 1-2% for incidence and 2-4% for mortality[4]. CVD is the most common cause of death in Peoples Republic of China and Taiwan and the proportion of CVD death (particularly CAD) has almost tripled from 12% in 1957 to 36% in 1990[5]. Japan has had the lowest rate of CAD among all industrialized countries for the past 50 years. Despite its affluence & rapid urbanization, Japan has not only avoided the epidemic of CAD but also reduced their already low rate by 60%[6]. From 1960 to 1990, the CAD prevalence increased two fold (from 2% to 4%) in rural India and three fold (from 3.5% to 9.5%) in urban India[7].

Current Scenario in Nepal:

CAD is one of the commonest Cardiovascular diseases seen by physicians in their hospital & private practice. Exact national data on incidence of CAD in Nepal is not available. Smoking, dyslipidaemia, hypertension, diabetes, physical

inactivity are conventional risk factors[8]. Different studies have shown high prevalence of these risks factors. The prevalence of hypertension in population above the age of 20 in four different geographic regions of Nepal showed highest rate in urban Kathmandu (10%), followed by rural Terai, Parsauni (8.1%), rural hill Kathmandu, Bhadrabas (6%), and the mountain region, Jumla (5.3%)[9]. The incidence of hypertension for men and women in hilly rural village, Kotyand was 4.8% and 6.6% respectively and 14% and 8.1% respectively in suburban village Bhadrakali[10]. Diabetes constituted 4% of total medical In- patients and their number is increasing[11]. A study done in different ecological regions of Nepal indicated that prevalence of tobacco use in adults was 68.4% in rural Kathmandu, 37.0% in urban Kathmandu, 54.7% in Terai region and 77.7% in mountain region. It was interesting to note that in the mountain region, the female smoking rate was 71.6%, which is one of the highest reported in the world from anywhere[12].

Definite diagnosis of myocardial infarction was made in Nepal in 1945. A few cases were seen in 1950 and in the sixties the incidence started rising rapidly. In a study between 1960-1968 a total of 150 cases of myocardial infarction was reported from Kathmandu, Nepal. Among them 89.9% were smokers, 28% were hypertensives, 14.3% diabetics and 25.4% had hypercholesteraemia. The male, female ratio was 6.5[13]. A study done 6 yrs ago using Rose Questionnaire & E.C.G. showed the prevalence of CAD among civil servants of Kathmandu above 35 yrs of age to be 4.8%[14]. In 1990, the admission pattern of Teaching hospital, Kathmandu showed respiratory diseases to be leading cause followed by gastrointestinal and cardiovascular diseases. However, in 2000 cardiovascular diseases constituted 20% of medical admissions out of which 8% were CAD. The ten years data of teaching hospital among CAD patients showed 74% male and 26% female. Among them 82% were smokers, 40% hypertensives, 22% diabetics, 20% showed raised LDL and 10% showed raised triglyceride[15]. In National Heart Centre Kathmandu CAD (21.7%) was second most common cause of hospital admission following rheumatic heart disease (29.3%)[16]. Hence these hospital-based datas show that the incidence of CAD is progressively increasing in Nepal with 6-fold increase in hospital admissions in the last 10 yrs.

Inter-Heart:

A multi centric global case control study designed to determine the strength of association between traditional and emerging risk factors and non-fatal AMI, the population attributable risk or burden of risk factors among each population group, whether the relative importance of risk factors varies across different populations and international variations in practice patterns of treatments for AMI has just been completed. Nepal has actively participated in this Inter-Heart Study and the results, which will be available during this year, is expected to give valuable insight.

Conclusion:

CAD is rapidly emerging as one of the major health problems in Nepal. The rapid change in lifestyle, unhealthy habits (tobacco use, sedentary life style etc), is considered to be responsible for the increase. Despite decrease in cardiovascular disease mortality in developed countries, substantial increases

have been experienced in developing countries. Hence large-scale epidemiological study should be carried out to determine the incidence & prevalence of CAD in Nepal and to find out the important risk factors and population based and high-risk strategies for primary and secondary prevention should be implemented.

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Gender Difference in the Coronary Risk Factors Amongst the Patients with Acute Coronary Events in Nepal

Bharat Rawat, Abhinav Vaidya, Jessen Gurung, Subhash Acharaya,Pravesh Basnet, H.S.Sodhi, Dambar Bahadur Karki, Sunil Chandra Jha
Norvic - Escorts International Hospital, Kathmandu, Nepal

Abstract:

Background: Acute Coronary Event (ACE) is the commonest cause of admission in Coronary Care Unit (CCU) in Nepal. With growing epidemic of coronary artery disease in Asian countries, there is an urgent need to assess the locally prevalent coronary risk factors. There seems to be a significant difference in the risk factors amongst male and female population. Methods: A prospective analysis was done in 404 consecutive patients admitted with an acute coronary event in CCU in the Norvic Escorts Health Care And Research Centre, Kathmandu from January 1999 to July 2002 .The data was analyzed and various risk factors were stratified. Results: Out of 404 patients of ACE, 251(62%) patients were males and 153 (38%) patients were females. The commonest risk factors amongst male patients were smoking in 160(64%), hypertension in 148(59%) and dyslipidemia in 133(53%), followed by diabetes in 80(32%) and a positive family history in 65 (26%) patients. As against this, female patients had commonest risk factors as hypertension in 71(47%), diabetes in 71(47%) and smoking in 64(42%), followed by a positive family history in 47(31%), and dyslipidemia in 23(15%) patients. Conclusions: Smoking is the most common risk factor followed by Hypertension and Dyslipidemia in male patients with ACE, but most female patients with ACE have Hypertension as the most common coronary risk factor followed by diabetes mellitus. This may be partly due to the difference of socio-economic status of two genders in Nepal. An aggressive preventive approach is mandatory to decrease the expensive burden of coronary artery disease in this poor Himalayan country.

Background:

In the Framingham Heart Study, 26-year follow-up of men and women aged 35 to 84 years indicated that CAD morbidity was twice as high in men as in

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women, and 60 per cent of coronary events occurred in men.[1] The onset of symptomatic CAD is typically about 10 years earlier in men, but CAD incidence in women increases rapidly at menopause. Women have the same modifiable risk factors as men,[2] although diabetes appears to confer greater risk in women than in men,[3] as may low HDL cholesterol and elevated plasma triglyceride.[4]

Acute Coronary Event (ACE) is the commonest cause of admission in Coronary Care Unit (CCU) in Nepal. With growing epidemic of coronary artery disease in Asian countries, there is an urgent need to assess the locally prevalent coronary risk factors. There seems to be a significant difference in the risk factors amongst male and female population. Not much data is available to assess if coronary risk factors were different in male versus female South Asian population.

Method and observations:

A prospective analysis was done in 404 consecutive patients admitted with an acute coronary event in CCU in the Norvic Escorts International hospital, Kathmandu from January 1999 to July 2002 .The data was analyzed and various risk factors were stratified.

Out of 404 patients of ACE, 251(62%) patients were males and 153 (38%) patients were females. The commonest risk factors amongst male patients were smoking in 160(64%), hypertension in 148(59%) and dyslipidemia in 133(53%), followed by diabetes in 80(32%) and a positive family history in 65 (26%) patients. As against this, female patients had commonest risk factors as hypertension in 71(47%), diabetes in 71(47%) and smoking in 64(42%), followed by a positive family history in 47(31%), and dyslipidemia in 23(15%) patients.

TABLE 1: GENDER DISTRIBUTION OF THE SAMPLE

Gender	No. (%)
Males	251(62%)
Females.	153 (38%)

TABLE 2: PREVALENCE OF RISK FACTORS IN THE TWO SEXES

	Males	Females	
1.	Smoking	160 (64%)	64(42%)
2.	Hypertension	148(59%)	71(47%)
3.	Dyslipidemia	133(53%),	23(15%)
4.	Diabetes Mellitus	80(32%)	71(47%)
5.	Positive family history	65 (26%)	47(31%)

BAR DIAGRAM SHOWING PREVALENCE OF DIFFERENT RISK FACTORS.

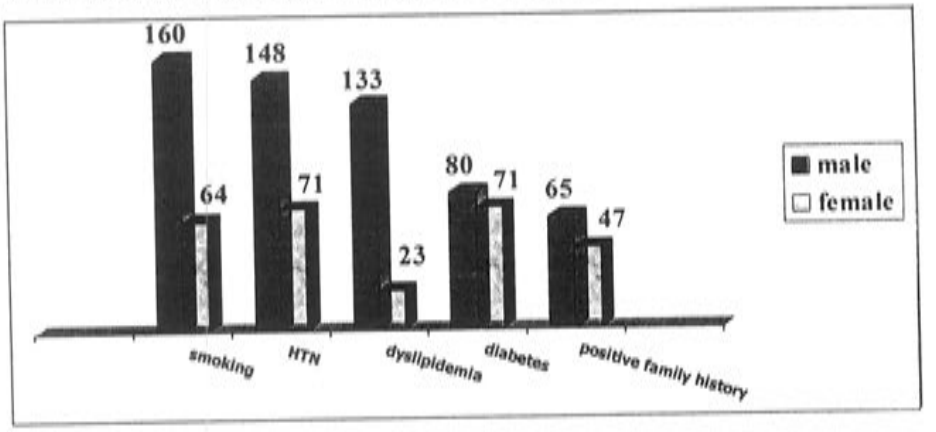

TABLE 3: THE TOP 5 RISK FACTORS IN MALES & THE FEMALES

	MALES	FEMALES
1.	**Smoking** 160 (64%)	**Hypertension** 71(47%)
2.	**Hypertension** 148(59%)	**Diabetes Mellitus** 71(47%)
3.	**Dyslipidemia** 133(53%)	**Smoking** 64(42%)
4.	**Diabetes Mellitus** 80(32%)	**Positive family history** 47(31%)
5.	**Positive family history** 65 (26%)	**Dyslipidemia** 23(15%)

Discussion and Conclusions:

Women suffering from an acute myocardial infarction are likely to be older and more likely to have a history of hypertension, diabetes, unstable angina, hyperlipidemia, and congestive heart failure and are less likely to be smokers than their male counterparts.[5-15] In this study also, smoking was found to be the most common risk factor in male patients with acute coronary event (ACE), followed by Hypertension and Dyslipidemia, but most female patients with ACE have Hypertension as the most common coronary risk factor followed by diabetes mellitus. This may be partly due to the difference of socio-economic status of two genders in Nepal. An aggressive preventive approach is mandatory to decrease the expensive burden of coronary artery disease in this poor Himalayan country.

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Pattern And Prevalence Of Rheumatic Heart Disease By Echocardiographic Evaluation

** Dr. R. K. Shah, Dr. A. B. Upadhyaya, Dr. L. P. Tibrewala, Dr. P. R. Regmi, Dr. K. P. Acharya, Dr. H. H. Khanal*

Background:

The pattern of cardiac disease differs from one region of the world to that of another[1]. rheumatic heart disease is still widely prevalent in Nepal[2]. The patterns and natural history is considerably different from what is seen in developed countries[3]. Few studies had been done in Nepal to address pattern of heart diseases[4]. Need of a large study to fill the gap and to show the profile of heart disease is there. This paper aims at providing the profile of heart disease as seen in Bir Hospital.

Materials and Methods:

Study Population:

Total number of cases was 11,290. Data analysis done among 10,436. Cases Patients having heart disease were 8654 while normal echocardiograms were 1782. Further analysis done among disease cases (N=8654).

Exclusion Criteria:

Patients having trivial mitral regurgitaiotn, grade I. Aortic regurgitaiton, degenerative valvular lesions and other non Rheumatic valvular lesion, were not included in this study.

PLACE

Cardiac unit, Bir Hospital Kathmandu, Nepal.

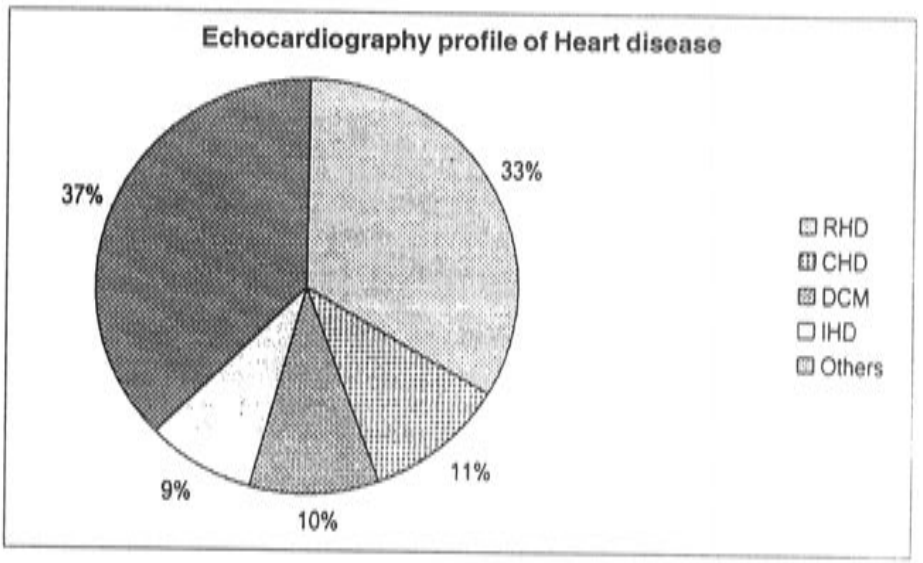
Period :

March 1986 to Feb. 2001

Address for Correspondence: Dr. R. K. Shah, Cardiac Unit, Bir Hospital, Kathmandu, Nepal. G.P.O. Box 801 I, Tel -528871 (Res.) Email:rkshah40@hotmail.com /rkshah40@yahoo.com Fax: 977-1-227374

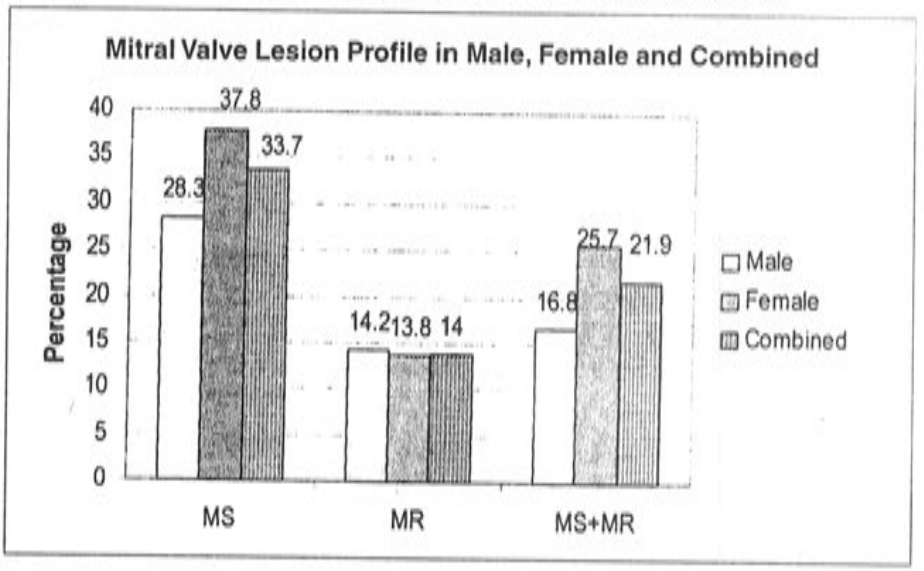
Result:

Echocardiography profile of Heart disease



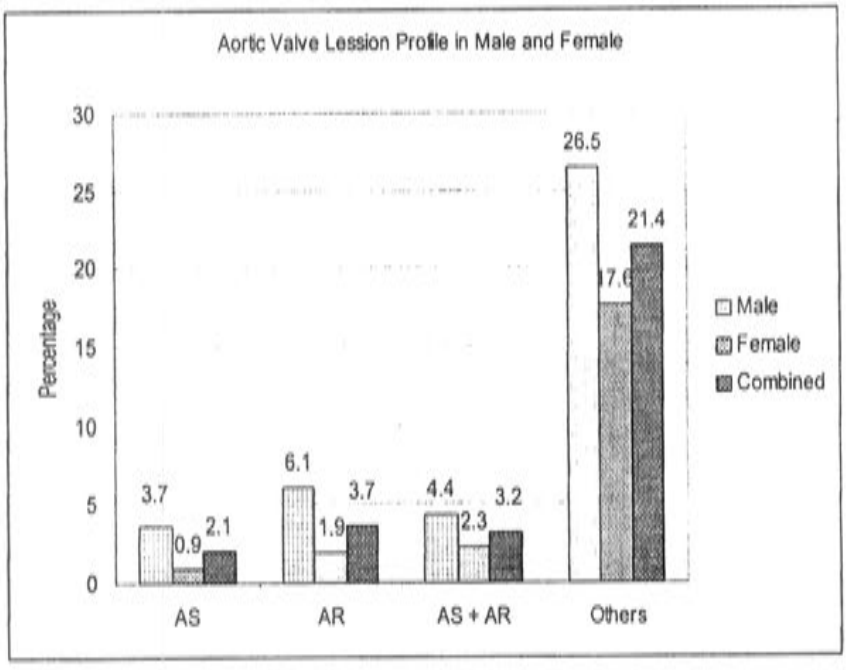
Rheumatic Heart disease (RHD)

Patient having rheumatic heart disease were 2890 (33.4%). Male cases were 1226 (42.4%) and female were 1664 (57.6%). Male and female ratio was 1:1.36. and age ranges from 7 year to 72 years. Mean age of male cases was 29.2 years, female was 30.6 years and combined mean was 29.9 years.



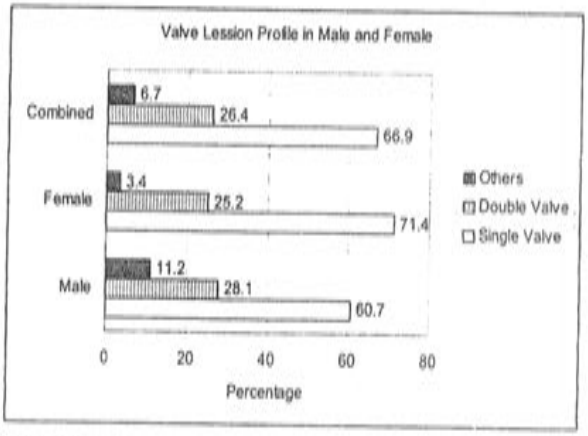
Mitral valve Lesion Profile

Lesion	Male N=1226	Female N=1664	Combined N=2890
MS	347 (28.3%)	628 (37.8%)	976 (33.7%)
MR	174 (14.2%)	230 (13.8%)	404 (14.0%)
MS+MR	206 (16.8%)	428 (25.7%)	634 (21.9%)



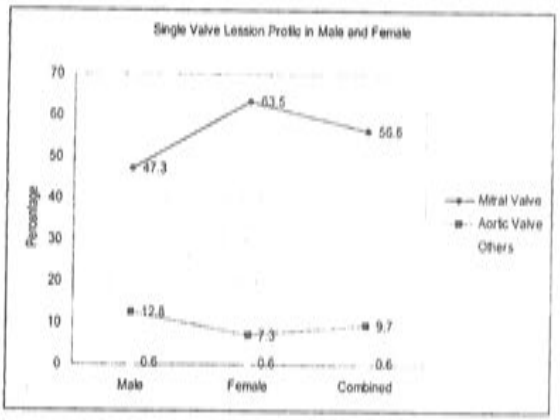
Aortic valve Lesion Profile

Lesion	Male N=1226	Female N=1664	Combined N=2890
AS	45 (3.7%)	15 (0.9%)	60 (2.1%)
AR	75 (6.1%)	31 (1.9%)	106 (3.7%)
AS+AR	54 (4.4%)	38 (2.3%)	92 (3.2%)
Others	325 (26.5%)	293 (17.6%)	618 (21.4%)



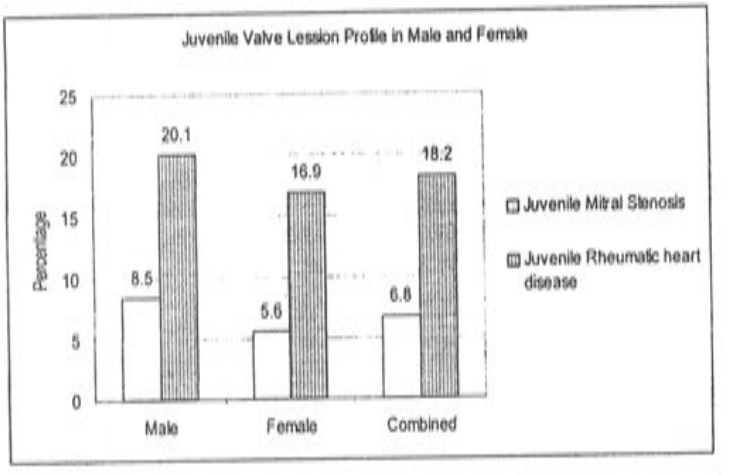
Valve Lesion Profile

Lesion	Male N=1226	Female N=1664	Combined N=2890
Single Valve	745 (60.7%)	1189 (71.4%)	1934 (66.9%)
Double Valve	344 (28.1%)	419 (25.2%)	763 (26.4%)
Others	137 (11.2%)	56 (3.4%)	193 (6.7%)



Single valve Lesion Profile

Lesion	Male N=1226	Female N=1664	Combined N=2890
Mitral Valve	580 (47.3%)	1056 (63.5%)	1636 (56.6%)
Aortic Valve	158 (12.8%)	123 (7.3%)	281 (9.7%)
Others	7 (0.6%)	10 (0.6%)	17 (0.6%)



Juvenile valve Lession Profile

Lesion	Male N=1226	Female N=1664	Combined N=2890
Juvenile Mitral Stenosis	104 (8.5%)	93 (5.6%)	197 (6.8%)
Juvenile Rheumatic heart Disease	246 (20.1%)	281 (16.9%)	527 (18.2%)

Discussion:

Total cases of rheumatic heart disease were 2890 (33.4%). Pure Mitral Stenosis was most common valvular lesion 976 (33.7%).Cases of AR 106 (3.7%) was more than AS 60 (2.1%). Percentage of MS in Female 629 (37.8) was higher than in Male 347 (28.3%). Pure AS and pure AR were dominant lesion in male. [45 (3.7) and 75 (6.1 %)] than in female [15(0.9%) and 31 (1.9%)] respectively.

Combined MS and MR were also dominant lesion in female 428 (21.9%) than in male 206 (16.8%). But mixed AS and AR was commoner in male 54 (4.4%) than in Female 38 (2.3%). Cases of single valve (67.6%) lesion were more than double valve (26.4%). Single valve lesion was dominant in Female (72.1% versus 61.6%) while double valve lesion was dominant in male (28.1% versus 25.2%). Juvenile Ms was 197(6.8%) and Juvenile RHD 527 (18.2%).

One study done in Bangalore 5, India where patients having mitral stenosis alone was less than this study (14.3% versus 33.7%) while mixed mitral stenosis and mitral Regurgitation was more (24.8% versus 21.9%), patients having involvement of both mitral and Aortic valves were more (40.3%) versus 26.4%). Study in an out patients cardiac clinic, Addis ababa shows patients having rheumatic heart disease were more (159.4% versus 33.7%) and patients with congenital heart disease were also more (35.9 verses 10.8%). Lowest age of

presentation of rheumatic heart disease was 7 year while a study done in the outpatient department of the National Center for control of rheumatic fever and heart diseases Dhaka. lowest age was 5 years.

Conclusion:

Rheumatic Heart disease is most common heart diseases (33.4 percent). Females outnumbered males (1.36:1)

Commonest valvular lesion is mitral stenosis (33.7 percent)

Juvenile mitral stenosis is common (6.8 percent) and Juvenile RHD (18.2 percent)

Single valve lesion is 2.5 times commoner (66.9 percent) than double valve (26.4 percent).

Acknowledgment:

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Intraoperative Transesophageal Echocardiography in Nepal

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Abstract:

Intraoperative transesophageal echocardiography is an important tool for intraoperative evaluation of mitral valve repair. A total of 29 patients who underwent intraoperative transesophageal (TEE) between 25th June, 2001 to 30th Dec, 2002.at Shahid Gangalal National Heart Centre, Kathmandu were studied. The age ranged from 14 to 48 years with mean age of 30 years. There were 11 male and 18 female patients.Twenty three patients had mitral valve repair for Severe mitral regurgitation, which was successful in 15 patients and rest underwent prosthetic valve replacement. Five patients had undergone closed mitral commissurotomy with 4 patients having successful dilatation and 1 patient had annular tear which was converted to open repair with mitral valve ring. One patient had huge aortic aneurysm which was successfully repaired. TEE has been proven to be extremely useful in intraoperative evaluation of mitral valve repair and may help to a timely reintervention, if needed. . This is the first study of intraoperative transesophageal echocardiography in Nepal.

Key Words: Intraoperative, transesophageal echocardiography(TEE), Mitral regurgitation (MR).

Introduction:

Intraoperative echocardiography is a valuable adjunct in the evaluation of surgical procedures for various cardiac surgical procedures like primary valvular heart disease, thoracic aortic disease and a variety of other indications such as neoplastic or traumatic cardiac disease. Shahid Gangalal National Heart Centre, Kathmandu is only center in Nepal where intraoperative TEE is a routine procedure for evaluation of valve repair. This is the first study of intraoperative TEE in 29 patients undergoing cardiac surgery at Shahid Gangalal National Heart Centre, Kathmandu, Nepal.

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Patients and Method:

A Total of 29 patients who underwent intraoperative TEE between 25th June,2001 to 30th Dec, 2002 at Shahid Gangalal National Heart Centre, Kathmandu were studied. The age ranged from 14 to 48 years with mean age of 30 years. 11 were male and 18 were female. Multiplane SMHZ TEE probe (Aloka SSD 2200,5500) was used for the study.

TEE Procedure:

TEE probe was introduced with the patient in supine position after endotracheal intubations , general anesthesia and sterile draping. Digital introduction and guidance of the instrument around the endotracheal tube was most often all that was needed for oesophageal intubation with occasional anteflexion of neck to allow passage of the TEE probe without disturbing the position of endotracheal tube.

Cardiac Examination:

The cardiac images were obtained by transducer position as recommended by ASE/SCA guideline for performing a comprehensive multiplane transesophageal examination[2].

Grading of mitral regurgitation (MR) based on intraoperative TEE was as following: Grade I, II, III, IV. Failure of repair was defined as MR of > Grade II. Mitral regurgitation was defined as by composite Doppler analysis as O= Absent; I=mild-narrow and localized regurgitant jet without eccentric trajectory; II=moderate regurgitant jet occupying approximately 25% to 33% of left atrium without wraparound; III=moderate-severe regurgitant jet occupying approximately 50% of the left atrium wraparound and systolic venous flow reversal absent; IV=severe regurgitant jet occupying >50% of the left atrium or with significant left atrial wraparound if eccentric and with systolic pulmonary venous flow reversal present3. Postoperative transthoracic echocardiography was performed in all patients evaluated by intraoperative TEE.

Indication for TEE:

The indications for intraoperative TEE were

1. Evaluation of mitral valve repair: 23
2. Evaluation of Closed mitral commissurotomy : 5
3. Evaluation of aortic aneurysm repair : 1

Results:

All patients had rheumatic valve for replacement or repair. Among 23 patients attemted for mitral valve repair intraoperative TEE findings were suggestive of good repair (MR < grade II) in 15 patients. In rest of 8 patients MR was II or more and was considered unsuccessful. So a second round run of cardiopulmonary bypass was started and valve replaced with a bileaflet prosthetic valve. Among 5 patients who had undergone closed mitral commissurotomy 4 patients had successful dilatation and 1 patients had annular tear with moderate to severe mitral regurgitation which was timely detected by intraoperative TEE and which

was successfully repaired with mitral valve ring. One patient had huge aortic aneurysm which was successfully repaired.

Discussion:

Mitral valve repair is now clearly favored over prosthetic valve replacement for the surgical treatment of mitral regurgitation[4,5,6,7]. Mitral valve repair is associated with improved operative[6] and late mortality[7] and with minimization of potential complications associated with mitral prosthesis such as thromboembolism[7,8], infective endocarditis[9] and bleeding secondary to anticoagulant therapy[11] . Vital to the effectiveness of mitral valve repair is intraoperative assessment of mitral competence after reconstructive procedure. Rheumatic heart disease is the commonest cardiac disease in Nepal[10] and rheumatic mitral regurgitation was most common indication for intraoperative TEE in the study. Semiquantitation of mitral regurgitation severity by TEE color doppler imaging in which Jet width at the regurgitant orifice, central Jet area and dimensional ratio are compared with those of the left atrium has been shown to correlate with gradation by left ventricular angiography[11]. In 143 patients studied for mitral valve repair for mitral regurgitation studied by intraoperative TEE by Freeman et al., mostly with myxomatous disease with or without chordal rupture, significant mitral regurgitation was detected by composite TEE doppler study in 11 (7.7%) patients and promted successful revision or replacement in a11 but 1 patient[12]. In our study successful mitral valve repair was done in 15 out of 23 selected patients with severe mitral regurgitation. Intraoperative TEE evaluation led to the decision of replacement in rest 8 patients. Mitral valve repair is a standard technique with low mortality,complication and reoperation rate. Most mitral valve repair failures appeared to be valve related , progressive primary valvular disease, endocarditis or leaflet retractioni. Mitral valve regurgitation is known complication requiring valve replacement in patients with severe mitral stenosis undergoing closed mitral commissurotomy. In the study 4 patients had successful opening of mitral valve in severe mitral stenosis. One patient had annular tear with moderate to severe mitral regurgitation detected by intraoperative TEE and timely successful mitral valve repair was performed. One patient had huge aortic aneurysm which was successfully repaired. Intraoperative TEE was useful in delineation of arch. Because the esophagus lies in close proximity of the thoracic aorta, especially the distal arch and the descending portion imaging from the vintage point provides multiple outstanding echocardiography windows for the delineation of aortic anatomy and abnormalities.

Complication:

No complications related to TEE were noted in the post operative period. There was no incidence of hoarseness of voice, pharyngeal or esopharyngeal trauma.

Limitation of the study:

This is small study of only 29 patients. Only 23 patients with severe rheumatic matral legurgitation were selected for mitral valve repair.

Summary:

Intraoperative transoesophageal echocardiography has proven to be extremely useful in evaluation of the quality of mitral valve repair and timely re-intervention if needed. Wider use of Intraoperative TEE should be practiced during cardiac surgical procedure especially during mitral valve repair.

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Comparison of Plain X-ray finding of Ventricular Enlargement with Echocardiography

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Abstract

Chest radiography is one of the first line investigations done to assess the cardiac size to rule out cardiomegaly. The present study was undertaken to compare the plain radiographic findings of ventricular enlargement with that of echocardiography.

39 patients with enlarged cardiac size based on cardio-thoracic ratio on chest X-ray underwent echocardiographic assessment. 29 male patients and 10 female patients were included in this study during a period of ten months in the year 2002. The median age was 51.0 years. Measurement of left ventricular enlargement based on the criterion developed by Devereux (1987) showed that 44.8% of males and 30.0% of females (total 41%) had enlarged left ventricular mass per square meter of body surface who had enlarged cardiac shadows based on CT ratio measured on chest X-ray. According to the criterion set by American College of cardiology (1983) showed that only 51% of the total subjects who had enlarged cardiac size in chest radiography were found to have enlarged left ventricle. When compared with the Nomogram values, end diastolic volume, end systolic volume and left ventricular posterior wall as diastole showed 15.4%, 28.3%, 43.6% and 23.0% of the total patients having enlarged left ventricle, who were having enlarged cardiac size based on the chest radiography. These values are statistically insignificant to prove the validity of CT ratio used to diagnose enlarged cardiac size. A maximum of 51.3% and a minimum of 15.4% (average 33.5%) of the patients having enlarged cardiac size having no obvious radiographic markets on chest radiography of cardiac illness were proven to have cardiomegaly by various criteria using echocardiography. The left ventricular enlargement according to left ventricular mass by body surface area calculated by parameter specified by Devercux (1987) and American College of Cardiology (1983) had comparable values. Left ventricular size measured by systolic and diastolic volumes and wall thickness criteria had different values.

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Key words: Ventricular enlargement, Echocardiography, CT ratio

Introduction

The accurate measurement of heart size including ventricles is best made with cross-sectional imaging, especially echocardiography and MRI. Methods for assessing the size of the ventricles, including ventricular enlargement, on the plain radiography are less accurate but are still useful and one of the basic investigations performed. The simple radiographic techniques used are the transverse cardiac diameter and the cardiothoracic ratio.

Ventricular enlargement is one of the commonly diagnosed findings in the department of radiology, Tribhuvan University Teaching Hospital (TUTH) amongst the patients undergoing plain chest radiography. It is commonly seen in patients presenting with symptoms of cardiac and respiratory system disease. The exact incidence of the disease in Nepal is not well known. However, by the number of cases diagnosed, it can be assumed that this is one of the common public health problems in our country having a rising trend.

Cardiomegaly, including ventricular enlargement, is one of the manifestations of the cardiovascular disease. The distribution of the disease is worldwide and is common amongst those having cardiomyopathy, valvular and congenital heart disease, heart failure, cor pulmonale, pulmonary hypertension, high cardiac output states and chronic pressure overload.

The diagnosis of cardiomegaly including ventricular enlargement depends upon imaging findings of plain chest x-ray and confirmed by the direct visulisation of the heart chambers (echocardiography and MRI). The diagnosis made by exclusively available plain x-ray is varied therefore it is desirable to confirm the diagnosis by echocardiography, which is available in most of the specialist centers including TUTH.

This study was designed to compare the result of plain x-ray findings with the echocardiography findings. The study was conducted in the department of radiology and the department of medicine (cardiology).

Aim and objective of the study

To find out the diagnostic accuracy of plain chest x-ray and compare it to the findings obtained on the same subjects on transthoracic echocardiography.

Materials and Methods

The study was a hospital based cross-sectional study. 39 cases referred to radiology department for chest x-ray and who were found to have enlarged cardiac size were selected on quota sampling basis and taken for echocardiography by the cardiologist.

Study algorithm

TUTH Out-patient/patient Departments

↓

Cases referred to Radiology department for chest x=ray

↓

Cardiomegaly on chest x-ray

↓

Echocardiography

↓

Results compared

Criteria of selection and exclusion of subject

Inclusion criteria

1. Patient attending the radiology department for plain chest radiography who are diagnosed as having enlarged ventricles.
2. Adult subjects of any age and sex.

Exclusion criteria

1. Patients with selective right atrial or left atrial enlargment.
2. Disputed plain radiography finding.
3. Patients with known cardiac disease.

Methods of study

The standard postero-anterior (PA)s projection[2] of the chest was obtained with high kilovoltage (120-140 KVp) and high milliamperage (700 mA) technique at maximum inspiration to permit short exposure times, which stop cardiac motion, and sufficient penetration to visualise retrocardiac structures and pleural reflections. A tube-to-film distance of at least 6 feet was used to minimize distortion and magnification.

All echocardiographic studies were performed using Hitachi Ultrsound Scanner EUB-555 unit utilizing 2.5 and 5.0 MHz, 2.5 cm diameter by one observer in the Department of cardiology, TUTH to avoid inter-observer bias.

The heart was imaged in a number of standard planes-long axis, short axis, and four-chamber planes. Likewise, the great vessels were transected in long and short axis with respect to the aorta to exclude the case in case there is any gross pathology in the great vessels.

After getting all the data the left ventricular mass was calculated using the formula[5].

LV Mass=1.04 g/cc $[(D+IVS+PW)^3 - D^3] - 14g$

Where, D means LV dimension, IVS means inter-ventricular septal dimension and PW means left ventricular posterior wall. All dimensions measured in cm at end diastole.

All the data were from primary source such as from plain PA chest radiography and echocardiography, All the data were evaluated by standard statistical methods.

Observation and Result

Table No. 1
Left ventricular mass/m² body surface area[6]
(values based on Devereux R B 1987)

Sex	Left ventricular mass		Total
	<134 g/m²	>134 g/m²	
Male	55.2% (n=16)	44.8% (n=13)	100% (n=29)

Sex	Left ventricular mass		Total
	<100 g/m²	>100 g/m²	
Male	70% (n=7)	30% (n=3)	100% (n=10)
Total	59% (n=23)	41% (n=16)	100% (n=39)

Using the values based on Devereux R B (1987) for left ventricular mass/m² body surgace area 44.8% of the males and 30% of the females had enlarged left ventricular mass. This added up to 41% of the total study population.

Table No. 2
Left ventricular mass based on Nomogram values[7]
Woyther J N, Singer S H, Kwan O H, et al 1983)

Sex	Left ventricular mass		Total
	<254 g	>254 g	
Male	79.3% (n=23)	20.7% (n=6)	100% (n=29)
Female	100% (n=10)	0% (n=0)	100% (n=10)
Total	84.6% (n=33)	15.4% (n=6)	100% (n=39)

Using the nomogram values based on Woyther J N, Singer S H, Kwan O H, et al (1983) for left ventricular mass, 20.7% of the males and 0% of the females had left ventricular mass more than 254 gram which is the upper limit of normal. The population with enlarged left ventricular mass according to this nomogram value was 15.4%.

Parameters based on American College of Cardiology (1983)[8]

Table no. 3
End diastolic volume

Sex	EDV		Total
	<90 ml/m²	>90 ml/m²	
Male	75.8% (n=22)	24.2% (n=7)	100% (n=29)
Female	60.0% (n=6)	40.0% (n=4)	100% (n=10)
Total	71.7% (n=28)	28.3% (n=11)	100% (n=39)

Parameters based on American College of Cardiology (1983), using the end diastolic volume to calculate the heart size it was found that 24.2% of the males and 40% of females had end diastolic volume in excess of 90 ml/m², which was taken as the abnormal criterion. This corresponds to 28.3% of the study population.

Table No. 4
End systolic volume[8]

Sex	ESV		Total
	<34 ml/m²	>34 ml/m²	
Male	62.0% (n=18)	38.0% (n=11)	100% (n=29)
Female	40.0% (n=4)	60.0% (n=6)	100% (n=10)
Total	56.4% (n=22)	43.6% (n=17)	100% (n=39)

Using the end systolic volume to calculate the heart size it was found that 38.0% of the males and 60% of females had end diastolic volume in excess of 34 ml/m², which was taken as the abnormal criterion. This corresponds to 43.6% of the study population.

Table No. 5
Left ventricular mass[8]

Sex	LVM		Total
	<90 g/m²	>90 g/m²	
Male	41.3% (n=12)	58.7% (n=17)	100% (n=29)
Female	70.0% (n=7)	30.0% (n=3)	100% (n=10)
Total	48.7% (n=19)	51.3% (n=20)	100% (n=39)

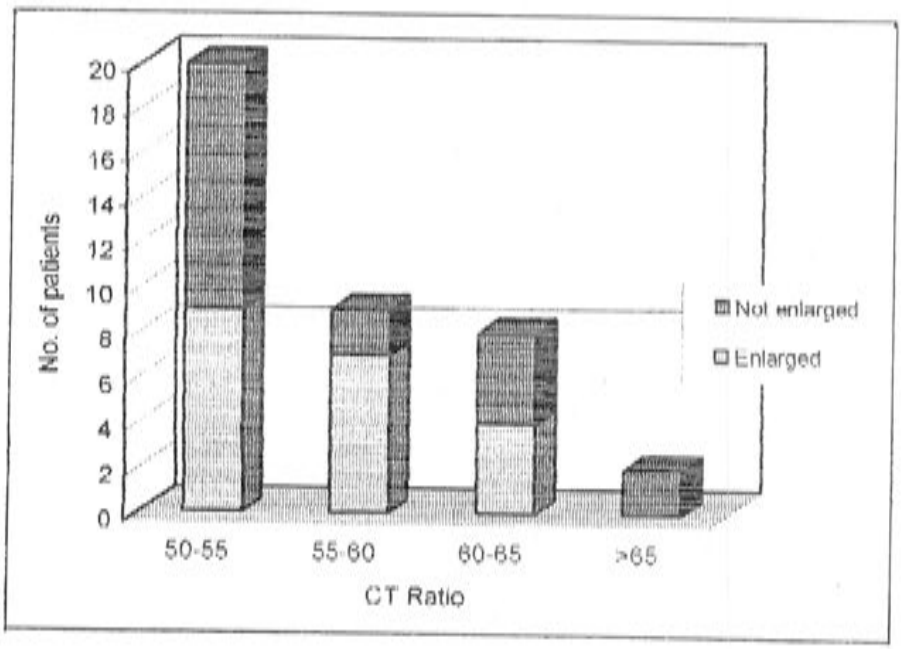
Using another parameter set by American College of Cardiology (1983), with the upper limit of left ventricular mass set at 90 g/m² it was found that 58.7% of the males and 30% of females had enlarged left ventricle which corresponds to 51.3% of the study population.

Table No. 6
Left ventricular posterior wall at diastole[8]

Sex	PW		Total
	<12.9 mm	>12.9 mm	
Male	51.3% (n=20)	48.7% (n=9)	100% (n=29)
Female	100% (n=10)	0.0% (n=0)	100% (n=10)
Total	77.0% (n=30)	23.0% (n=9)	100% (n=39)

Using the measurements of the left ventricular posterior wall at diastole it was seen that 48.7% of the males and 0.0% of females had end diastolic volume in excess of 12.9 mm, which was taken as the abnormal criterion. This corresponds to 23.0% of the study population.

Bar diagram showing the number of patients with left ventricular enlargement compared with CT Ratio and LV mass index per sq. metre of body surface[9]



This figure shows the number of patients having left ventricular enlargement (LV mass index (>108/m² of body surface area) plotted against radiologically enlarged cardiac size (CT ration >50). Out of 20 patients in the category of Ct ration of 50-55 nine (45%) patients had enlarged cardiac size echocardiographically. In the category 55-60, seven out of nine (77%) had cardiomegaly. In the category 60-65 CT ratio four out of eight (50%) of the patients showed cardiomegaly. Of the total number of patients, twenty showed cardiomegaly echocardiographically when this criterion[79] was used.

Discussion

Conventionally chest x-ray PA view was routinely done to assess the size of the heart taking cardio-thoracic ratio as the standard measurement, but with the advent of newer technique, e.g., echocardiography this study was conducted to test the reliability of chest x-ray in the diagnosis of cardiomegaly.

In this study, which comprised of 39 patients who had been reported as having enlarged cardiac size by chest radiography underwent echocardiographic assessment. Different echocardiographic parameters of enlarged left ventricular mass were calculated based on Devercux (1987), Wyother (1983) and American College of Cardiology (1983). Some of the echocardiographic criteria developed by different authors and atuthorities had comparable findings, where as others differed. The following table illustrates the result.

Table No. 7
Comparison of LV size by different measurement parameters

Parameter	Enlarged left ventricle		Total
	Male	Female	
LV mass/m²	44.8%	30.0%	41.0%
LV mass >90 g/m²	58.7%	30.0%	51.3%
Nomogram values	20.7%	0.0%	15.4%
End diastolic vol.	24.2%	40%	28.3%
End systolic vol.	38.0%	60%	43.6%
LV posterior wall at diastole	48.7%	0.0%	23.0%

Measurement of left ventricular enlargement based on the criterion developed by Devercux (1987) showed that 44.8% of males and 30.0% of females (total 41%) had enlarged left ventricular mass per square meter of body surface who had enlarged cardiac shadows based on CT ratio measured on chest x-ray.

Left ventricular enlargement using left ventricular mass per sq. metre (devereux, (1987) and left ventricular mass more than 90 g per sq. meter (Am Col Card 1983) were comparable. According to the criterion set by American College of Cardiology (1983) showed that only 51% of the total subjects who had enlarged cardiac size in chest radiography were found to have enlarged left ventricle.

Similarly, when compared with the Nomogram values[10], end-diastolic volume, end systolic volume and left ventricular posterior wall as diastole showed 15.4%, 28.3%, 43.6% and 23.0% of the total patients having enlarged left ventricle, who were having enlarged cardiac size based on the chest radiography. These values are statistically insignificant to prove the validity of CT ratio used to diagnose enlarged cardiac size.

In this study a maximum of 51.3% and a minimum of 15.4% (average 33.35%) of the patients having enlarged cardiac size having no obvious radiographic markers on chest radiography of cardiac illness were proven to have cardiomegaly by various criteria using echocardiography.

Out of 20 patients in the category of CT ratio of 50-55, nine (45%) patients had enlarged cardiac size echocardiographically. In the category 55-60, seven out of nine (77%) had cardiomegaly. In the category 60-65 CT raion four out of eight (50%) of the patients showed cardiomegaly. Of the total number of patients twenty showed cardiomegaly echocardiographically when this criterion[79] was used.

A cardiac size measurement by chest radiograph is a relatively simple procedure with less inter-observer variability provided the technical factors governing the cruor are minimized and can therefore be used as screening tool.

Chamber enlargement may be easy to diagnose by plain radiography when the chamber enlargement is gross, when it is confined to a single cardiac chamber, or when there is supporting evidence of abnormality from the aorta or pulmonary vessels. There are many facilities in the diagnosis of selective chamber enlargement produced either by chamber displacement mimicking enlargement, or by other structures that may resemble enlarged chambers. Additionally, apparent abnormalities of cardiac size and shape, resembling overall a selective chamber enlargement, may result from skeletal abnormalities, particularly of the sternum or dorsal spine. In practice these seldom affect management as chamber enlargement is confined and better assessed by cross-sectional imaging, usually by two-dimensional echocardiography.

Chest radiography is not a sensitive method of detecting selective left ventricular enlargement, nor of recognizing it in the presence of enlargement of the other chambers. Echocardiography, CT and MRI allow much more precise assessment of chamber size.

Echocardiography being a very safe and easy to operate investigative tool can be used both in pregnant and non-pregnant females and is devoid of any radiation hazards and can be repeated on a person without risking him/her for the known side effects of x-rays. With the availability of simple, user-friendly portable and cheaper echocardiography machines it can be used as a more accurate, reliable, economic and scientific tool for assessment of therapy, screening and research purposes and many other wider applications.

Full dependence on chest radiography only to assess and diagnose the cardiac size may result into incomplete and inaccurate information to be required for the management of the patient.

Hence, it is advisable to conduct echocardiography on all cases of cardiomegaly that is diagnosed by chest x-ray irrespective of the clinical findings.

Conclusion

In most adult patients with acquired heart disease, the disease process, although beginning on the left side of the heart, will eventually involve the pulmonary circulation and the right heart chambers, leading to gross cardiac enlargement. When this occurs, all the cardiac chambers are likely to be involved, and it is not possible to determine the contribution of each chamber with plain radiography, other than possibly the left atrium. The heart with all chambers enlarged takes on a globular shape, which is readily seen by plain chest radiographs.

Chamber enlargement may be easy to diagnose by plain radiography when the chamber enlargement is gross, when it is confined to a single cardiac chamber, or when there is supporting evidence of abnormality from the aorta or pulmonary vessels. There are many facilities in the diagnosis of selective chamber enlargement produced either by chamber displacement mimicking enlargement, or by other structures that may resemble enlarged chambers. Additionally, apparent abnormalities of cardiac size and shape, resembling overall a selective chamber enlargement, may result from skeletal abnormalities, particularly of the sternum or dorsal spine. In practice these seldom affect management as chamber enlargement is confined and better assessed by cross-sectional imaging, usually by two-dimensional echocardiography.

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Why Would Anyone Want to Become a Cardiologist These Days?

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The above question was asked by a sincere second-year medical resident who was struggling with the decision regarding career choices. Advice received by many, including the Chairman of Medicine, was to become an internist/primary care physician in order to maximize the probability of future employment security. This advice sounds very convincing in today's marketplace and seems to be supported by data and recommendations of many national and local bodies. Even the pages of this Journal have outlined the difficult problems faced by cardiologists and other subspecialists. The question is a critically important one for young house officers and deserves a thoughtful response. Some of my ideas are outlined below:

I. Opportunity. Heart disease remains the number one killer in the United States despite the progressive decline in heart disease mortality since about 1968. With the aging of the population, certain disorders such as heart failure are increasing in incidence and prevalence. Thus, the expertise of cardiologists is still critically important to the health of our country and the world. In a similar way, the research opportunities seem particularly exciting. Never before have we understood the process of atherosclerosis as well as we do today; and never before have the prospects for effecting real change in this disorder been as close. The same excitement and prospects are true for electrophysiology, heart failure and other cardiovascular disorders.

2. Intellectual stimulation. One of the exciting aspects of medical school training was the clinical challenge of evaluating a patient to determine the precise nature and severity of their underlying problem(s). This intellectual stimulation seemed especially relevant to a choice to train in internal medicine, where the challenges of diagnosis remain considerable. This further motivated us to become cardiologists, where both the history and physical examination were so crucial in evaluating patients. Although sometimes our technical advancements in noninvasive cardiology, such as echocardiography, have seerned to become more important to some than a detailed history and physical examination; in truth, the intellectual challenge of evaluating a patient has never been stronger, precisely because of our ability to corroborate our impressions. An understanding of pathophysiology is also critical in understanding the varied courses that patients take.

3. We can really help the patient. In other subspecialties, the intellectual stimulation is similar to that of cardiology in the evaluation of patients. Neurology comes to mind, where the history and physical examination are essential to understanding the location and pathophysiology of the problem many other subspecialties, however, cardiologists have the tools to alter the course of the disease. The explosion of knowledge in the past few decades has allowed us to really help patients. Whether it is prevention or complex treatment, we are blessed to provide so many options for our patients. Thrombolysis, angioplasty, stents, surgery and radiofrequency ablation and a powerful array of medications have transformed the care of patients with heart disease. As we read the journals, we are struck by the enormous numbers of cardiovascular trials and their impact on our abilities to care for people. Nothing is more satisfying than this aspect of cardiology.

4. My patient is my friend. Nothing is personally more important in medicine than the relationships we develop with our patients. Disease of the heart seems to especially strike an emotional note with people. Because of the complexities of evaluation and discussions of treatment options, we spend much time with patients. The chronic nature of much of heart disease also allows our periodic visits together to help us to become friends. What better way to practice medicine than to spend time with lifelong friends. I have been struck recently with experiences with patients followed over one to two decades who finally succumb not to heart disease, but to cancer. This chronicity of cardiac problems, indeed, frequently makes us their "primary care physician," to whom they turn for advice on treatment of other medical problems that accompany the aging process. Perhaps it is the way that individuals feel about their "heart" as the seat of emotions and their most important "organ" that bonds them to a cardiologist who can care for them. In any event, I find these "friendships" a rewarding stimulus for the practicing cardiologist.

5. Do what you really want to do. Many house officers complete their rotations in cardiology and are excited about what they learn. The ability to evaluate and treat critically ill patients and the rapidly changing nature of the specialty are often given as reasons for being interested in cardiology. I have long ago concluded that life is short, and one needs to be excited about coming to work each day. Although this particular aspect of a career choice is difficult to measure, I believe it is of great importance to lifelong job satisfaction. I would rate this idea of doing what you really want to do well above the idea of job security in a less stimulating position.

In outlining the above thoughts, I am not oblivious to the concerns of an "overabundance" of cardiologists or to the decline in numbers of training slots. Despite these problems, I really believe in the future opportunities for a career in cardiology. The next time a resident asks you the question, "Why would anyone want to become a cardiologist these days?" share this Editor's Page with them. As one reviews the above attributes of our specialty, maybe the question could well be, "Why would anyone NOT want to become a cardiologist?"

Risk Factor distribution in patients with Acute Coronary Syndrome

Dr. Man Bahadur K. C.

Coronary Artery disease is emerging as a growing epidemic in whole of the South Asia region. South Asians are genetically most predisposed people to Coronary Artery disease. In this background of genetic predisposition to Coronary Artery disease and changes in life style, which increases the vulnerability to acquire this disease, many Nepalese people are getting Coronary Artery disease with increasing number every year.

There are already well-established risk factors of Coronary Artery disease of which some are modifiable risk factors like smoking, life style and some are not modifiable like, heredity, age and male sex. Presence of major risk factors like smoking, hypertension, diabetes and dyslipidemia, alone or in combination, increases the predisposition to premature and sever CAD.

In this article, an attempt was made to assess distribution of risk factors in patients with Acute Coronary Syndrome (ACS) admitted in Coronary care unit (CCU) of Shahid Gangalal National Heart Centre. The data included the patients who were admitted in CCU of Shahid Gangalal National Heart Centre in between First Kartik 2058 to Last of Aswin 2059. The analysis included a total of 230 patients of which 176 (76.50%) were male and rest were female.

Table 1: Distribution of Risk Factors in Patients with ACS

S.N.	Risk Factors	No of Patients	Percentage
1.	Smoking	158	68.7
2.	Hypertension	108	47
3.	Diabetes Mellitus	57	24.8
4.	Dyslipidemia	85	37
5.	Obesity	24	10
6.	Family history of CAD	46	20
7.	Age (male>55, female>65	176	76.5
8.	Male Sex	157	68

Table 1: Single/Multiple Risk Factors in Patients with ACS

S.N.	Number of Risk Factors	No of Patients
1.	1	11
2.	2	33
3.	3	71
4.	4	63
5.	5	29
6.	6	14
7.	7	5
8.	0	2

Smoking is a major and independent risk factor of CAD. Smoking increases risk of CAD by 1.6 times, fatal and non-fatal myocardial infarction by 2.3 times, Cessation of smoking significantly reduces both the morbidity and mortality of CAD, nearly by 65%. Smoking acts synergistically with other risk factors of CAD like hypertension, diabetes mellitus, dyslipidemia and oral contraceptives in increasing the risk of CAD; Dose effect relationship exists in between number of cigarettes consumed per day, duration of smoking, starting age of smoking and odds ratio of CAD. Smoking more than 20 cigarettes per day results 2 to 3 times increased risk of developing CAD. Consumption of as few in 4 cigarettes per day increases the risk of CAD. Tobacco contains more than 10 kinds of pathogenic substances for development of CAD of which Nicotine and Carbon monoxide are two most important substances. Long-term smoking not only enhances the oxidation of LDL-C and reduction of HDL-C, the protective Cholesterol for heart, but also causes the damage to the endothelium, derangement of hemodynamic and coagulation mechanism, increased level of catecholamines in blood . Hypertension is also independent risk factor of CAD. The risk of development of CAD is parallel to level of risk of diastolic blood pressure. In Hypertensive subjects there is 27% increased in the risk of CAD, for every 7 mm/Hg increase in diastolic blood pressure . Even if the risk of development of CAD in subjects having upper normal limits of blood pressure level, i.e. Systolic blood pressure 120=139 mm/Hg and diastolic blood pressure of 80-90 mm/Hg is significantly higher than subjects having systolic blood pressure of less than 120 mm/Hg and diastolic blood pressure of less than 80 mm\Hg. Reduction in diastolic blood pressure of 5 to 6 mm/Hg reduces the risk of CAD by 14%. Diabetes is associated with insulin resistance syndrome and also causes marked impairment of endothelial and smooth muscle cell function and appears to have increased leucocytes adhesion to vascular endothelium, which is a critical early step in the genesis of atheroma. In diabetic subjects, the risk ofAMI is 50% higher in males, and 150% higher in females. Sudden cardiac death is also 50% higher in diabetics. Younger diabetes (45-64 years) were found to have

3.2 times higher mortality when compared to older group. The diabetes also have three fold to five fold increased rate of future cardiovascular events, the risk is even higher in diabetic women.

The level of LDL-C has positive correlation with future risk of development of CAD. Because increased level of LDL-C is associated with increased damage of endothelium, which is critical step for atherogenesis. Similarly increased level of HDL-C is negatively correlated with future risk of development of CAD, because HDL-C helps to transfer cholesterol from periphery to liver, which is the main component of an atherosclerotic plaque.

A number of reports supports that subjects with excess body weight have increased risk of CAD. This may be due to the fact that the obesity may be associated with hyperlipidemia, hypertension and sometimes diabetes mellitus.

Males are more prone to CAD than female and males more than age of 55 and females more than age of 65 have significantly higher chance of developing CAD than subjects with age less than 55 and 65 respectively. Finally, the numbers of risk factors present in subjects with ACS were also reviewed. An interesting trend was observed that subjects with higher number of risk factors; had higher chance of having extensive myocardial infarction, hemodynamic derangement and premature CAD .

AHA Guidelines for Primary Prevention of Cardiovascular Disease and Stroke: 2002 Update

TABLE 1. Guide to Primary Prevention of Cardiovascular Disease and Stroke:

Risk Assessment	Recommendations
Risk factor screening Goal: Adults should know the levels and significance of risk factors as routinely assessed by their primary care provider.	Risk factor assessment in adults should begin at age 20 y. Family history of CHD should be regularly updated. Smoking status, diet, alcohol intake, and physical activity should be assessed at every routine evaluation. Blood pressure, body mass index, waist circumference, and pulse (to screen for atrial fibrillation) should be recorded at each visit (at least every 2 y). Fasting serum lipoprotein profile (or total and HDL cholesterol if fasting is unavailable) and fasting blood glucose should be measured according to patient's risk for hyperlipidemia and diabetes, respectively (at least every 5 y; if risk factors are present, every 2 y).
Global risk estimation All adults ≥40 y of age should know their absolute risk of developing CHD. Goal: As low risk as possible.	Every 5 y (or more frequently if risk factors change), adults, especially those ≥40 y of age or those with ≥2 risk factors, should have their 10-y risk of CHD assessed with a multiple risk score. Risk factors used in global risk assessment include age, sex, smoking status, systolic (and p g sometimes diastolic) blood pressure, total (and sometimes LDL) cholesterol, HDL cholesterol,[12,28] and in some risk scores, diabetes.[29,30] Persons with diabetes or 10-y risk >20% can be considered at a level of risk similar to a patient with established .cardiovascular disease (CHD risk equivalent). Equations for calculation of 10-y stroke risk are also available.

CHD indicates coronary heart disease.

TABLE 2. Guide to Primary Prevention of Cardiovascular Disease and Stroke:

Risk Intervention and Goals	Recommendations
Smoking Goal: Complete cessation. No exposure to environmental tobacco smoke.	Ask about tobacco use status at every visit. In a clear, strong, and personalized manner, advise every tobacco user to quit. Assess the tobacco user's willingness to quit. Assist by counseling and developing a plan for quitting. Arrange follow-up, referral to special programs, or pharmacotherapy. Urge avoidance of exposure to secondhand smoke at work or home.
BP control Goal: <140/90 mm Hg; <130/85 mm Hg if renal insufficiency or heart failure is present; or <130/80 mm Hg if diabetes is present.	Promote healthy lifestyle modification. Advocate weight reduction; reduction of sodium intake; consumption of fruits, vegetables, and low-fat dairy products; moderation of alcohol intake; and physical activity in persons with BP of ≥130 mm Hg systolic or 80 mm Hg diastolic. For persons with renal insufficiency or heart failure, initiate drug therapy if BP is ≥130 mm Hg systolic or 85 mm Hg diastolic (≥80 mm Hg diastolic for patients with diabetes). Initiate drug therapy for those with BP ³140/90 mm Hg if 6 to 12 months of lifestyle modification is not effective, depending on the number of risk factors present. Add BP medications, individualized to other patient requirements and characteristics (eg, age, race, need for drugs with specific benefits).
Dietary intake Goal: An Overall healthy eating pattern.	Advocate consumption of a variety of fruits vegetables, grains low-fat or nonfat dairy products, fish, legumes, poultry and lean meats. Match energy intake with energy needs and make appropriate changes to achieve weight loss when indicated. Modify food choices to reduce saturated fats (<10% of calories), cholesterol (<300 mg/d), and trans-fatty acids by substituting grains and unsaturated fatty acids from fish, vegetables, legumes, and nuts. Limit salt intake to <6 g/d. Limit alcohol intake (≤2 drinks/d in men, ≤1 dring/d in women) among those who drink.
Aspirin Goal: Low-dose aspirin in persons at higher CHD	Do not recommend for patients with aspirin intolerance. Low-dose aspirin increases risk for gastrointestinal bleeding and hemorrhagic stroke.

risk (especially) those with 10-y risk of CHD ≥10%).	Do not use in persons at increased risk for these diseases. Benefits of cardiovascular risk reduction outweigh these risks in most patients at higher coronary risk[25-27] Doses of 75-160 mg/d are as effective as higher doses. Therefore, consider 75-160 mg aspirin per day for persons at higher risk (especially those with 10-y risk of CHD of ≥10%).
Blood lipid management Primary goal: LDL-C <160 mg/dL if ≤1 risk factor is present; LDL-C <130 mg/dL if ≥2 risk factors are present and 10-y CHD risk is <20%; or LDL-C <100 mg/dL if ≥2 risk factors are present and 10-y CHD risk is ≥20% or if patient has diabetes. Secondary goals (if LDL-C is at goal range): If triglycerides are >200 mg/dL, then use non-HDL-C as a secondary goal: non-HDL-C <190 mg/dL for ≤1 risk factor; non-HDL-C <160 mg/dL for ≥2 risk factors and 10-y CHD risk £20%; non-HDL-C <130 mg/dL for diabetics or for ³2 risk factors and 10-y CHD risk >20%. Other targets for therapy: triglycerides >150 mg/dL; HDL-C <40 mg/dL in men and <50 mg/dL in women.	If LDL-C is above goal range, initiate additional therapeutic lifestyle changes consisting of dietary modifications to lower LDL-C: <7% of calories from saturated fat cholesterol <200 mg/d, and, if further LDL-C lowering is required, dietary options (plant stanols/sterols not to exceed 2 g/d and/or increased viscous [soluble] fiber [10-25 g/d]), and additional emphasis on weight reduction and physical activity. If LDL-C is above goal range, rule out secondary causes (liver function test, thyroid-stimulating hormone level, urinalysis). After 12 weeks of therapeutic lifestyle change, consider LDL-lowering drug therapy if: ≥2 risk factors are present, 10-y risk is >10%, and LDL-C is ≥130 mg/dL; ≥2 risk factors are present, 10-y risk is <10%, and LDL-C is ≥160 mg/dL; or £1 risk factor is present and LDL-C is ≥190 mg/dL. Start drugs and advance dose to bring LDL-C to goal range, usually a statin but also consider bile acid~inding resin or niacin. If LDL-C goal not achieved, consider combination therapy (statin+resin, statin+niacin). After LDL-C goal has been reached, consider triglyceride level: If 150-199 mg/dL, Veat with therapeuUc lifestyle changes. If 200-499 mg/dL treat elevated non-HDL-C with therapeutic lifestyle changes and, if necessary consider higher doses of statin or adding niacin or fibrate. If >500 mg/dL, treat with fibrate or niacin to reduce risk of pancreatitis. If HDL-C is <40 mg/dL in men and <50 mg/dL in women, initiate or intensify therapeutic lifestyle changes. For higher-risk patients, consider drugs that raise HDL-C (eg, niacin, fibrates, statins).
Physical activity Goal: At least 30 min of moderate-intensity physical activity on	If cardiovascular, respiratory, metabolic, orthopedic, or neurological disorders are suspected, or if patient is middle-aged or older and is sedentary consult physician before initiating

most (and preferably all) days of the week.	vigorous exercise program. Moderate-intensiiy activities (40% to 60% of maximum capacity) are equivalent to a brisk walk (15-20 min per mile). Additional benefits are gained from vigorous-intensity activity (>60% of maximum capacity) for 20-40 min on 3-5 d/wk. Recommend resistance Vaining with 8-10 different exercises, 1-2 sets per exercise, and 10-15 repetitions at moderate intensity ≥2 d/wk. Flexibility training and an increase in daily lifestyle activities should complement this regimen.
Weight management Goal: Achieve and maintain desirable weight (body mass index 18.5-24.9 kg/m²). When body mass index is ≥25 kg/m², waist circumference at iliac crest level ≤40 inches in men, ≤35 inches in women.	Initiate weight-management program through caloric restriction and increased caloric expenditure as appropriate. For overweight/obese persons, reduce body weight by 10% in first year of therapy.
Diabetes management Goals: Normal fasting plasma glucase (<110 mg/dL) and near normal HbAlc (<7%).	Initiate appropriate hypoglycemic therapy to achieve near-normal fasting plasma glucose or as indicated by near-normal HbAlc. First step is diet and exercise. Second-step therapy is usually oral hypoglycemic drugs: sulfonylureas and/or mettormin with ancillary use of acarbose and thiazolidinediones. Third-step therapy is insulin. Treat other risk factors more aggressively (eg, change BP goal to <130/80 mm Hg and LDL-C goal to <100 mg/dL).
Chronic atrial fibrillation Goals: Normal sinus rhythm or, if chronic atrial fibrillation is present, anticoagulation with INR 2.0-3.0 (target 2.5).	Irregular pulse should be verified by an electrocardiogram. Conversion of appropriate individuals to normal sinus rhythm. For patierds in chmnic or intermittent atrial fibrillation, use warfarin anticoagulants to INR 2.0-3.0 (target 2.5). Aspirin (325 mg/d) can be used as an alternative in those with certain contraindications to oral anticoagulation. Patients <65 y of age without high risk may be treated with aspirin.

BP indicates blood pressure; CHD, coronary heart disease; LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol; and INR, international normalized ratio.

Successful Repair of Ruptured Abdominal Aortic Aneurysm: A Case Report

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Introduction:

Abdominal aortic aneurysms (AAA) are the commonest arterial aneurysms being located mostly in the infrarenal aorta (1). Though pathogenesis of AAA is multifactorial including genetic predisposition, aging, atherosclerosis, inflammation and localised proteolytic enzyme activation, atherosclerotic degeneration of the arterial wall is the most common cause for this. Though other complications like thromboembolism may occur, AAA gains its importance mostly because of the fear of rupture. Aneurysm rupture is the cause of death in 1.2% of males and 0.6% of females in the United States. It is the 13t" most common cause of death in United States killing about 15,000 people annually. Once ruptured the condition carries a high degree of mortality even in the busy centres.

Case Summary:

A 54 years old gentleman presented from Gulmi to our emergency on 2058/11/15 BS (Feb.27, 2002) with complain of continuos pain abdomen for .3 days associated with one episode of vomiting. He also gave H/0 distension of abdomen for 1 day, decreased urinary output for 12 hours. He was taken to Palpa Tansen hospital 2 days after the onset of pain where he was rescucitated and managed with I/V fluids/antibiotics. USG abdomen done showed AAA and so they referred the patient to Kathmandu. But unfortunately he had to be taken from one hospital to another and he finally landed at our hospital 12 hours after he arrived in Kathmandu. On examination, the patient was in profound shock, was delirious with GCS of 11/15.He was markedly pale, pulse and R/R were 120 and 28 per minute respectively. B.P at right arm, left arm and right leg were 100/80,90/70,and 140/100 mmHg respectively. He had scanty red urine in the urobag suggestive of haematuria.On per abdominal examination, the abdomen was tender, there was a pulsatile abdominal mass in the central abdomen approximately 8x10 cm in size, bowel sound was present but sluggish and there was a systolic bruit heard in the epigastric region. On auscultation of precordium, both heart sounds were audible with no murmur. All the peripheral pulses were palpable except the left dorsalis pedis. His haemoglobin was 7.2gm%, serum urea

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18.Ommol/l, serum creatinine 241 microml, Blood sugar and electrolytes were within normal limit With all these history and findings we had a diagnosis of contained rupture of AAA with renal involvement and ARF, and we decided to operate on him. With the minimum investigations of haematology and biochemistry at our hospital, we rushed him to f operation theatre.

Abdomen was opened with upper and mid-line incision and the aorta was approached. There was about 300 ml of haemorrhagic fluid in the peritoneal cavity There was a huge retroperitoneal haematoma around the abdominal aorta with a huge AAA, extending ju from the infrarenal aorta to the bifurcation. Proximal aorty was taken into control at the level of diaphragma Distally both femoral arteries were taken into contral With both proximal and distal control with aortic cro clamp, the aneurysm was opened and all the blood and clot sucked out. Aorta was badly diseased wil atherosclerotic plaques and was very fragile. There was a tear of 2 cm in the proximal aneurysmal part. A 8 cm long, 16 mm diameter PTFE tube graft was used to reconstruct the aorta from the neck of the aneurysma sac superiorly to just proximal to bifurcation distally with continuos 2/0 prolene sutures in 30 minutes of aorti cross clamp. The aneurysmal sac was sutured over the graft. The abdomen was closed without a drain. Throughout the operation, the patient's blood pressur was maintained at a lower side with the help of sodium nitroprusside, nitroglycerine infusion drip and vasopressores.

Postop period:

The patient was severely acidotic during and just after the operation with a pH of 7.2 and base excess of -13.2 mmol/l. The patient was treated with soda bicarbonate, was paralysed and ventilated overnight to correct his acidosis. The patient was' extubated 17 hours after the operation.

The patient's blood pressure was maintained between 140-150/80-90 mm Hg in immediate postoperative period with the help of Sodium Nitroprusside, GTN drip followed by oral captopril and metoprolol from 2°d postoperative day. He remained delirious for 48 hours after extubation.

The patient was given IV lasix during and after operation to induce urinary output. On the day of operation, he received 80 mg IV lasix, 60 (20+40)mg on 1st POD after which he entered into diuretic phase of ARF producing 5742 ml urine on 2nd POD. His urea and creatinine were 20 mmol/L and 325 micromot/L respectively on 1st POD which gradually decreased to 8 mmol/L of urea and 127 micromol/L of creatinine on discharge.

Patient started passing bloody mucoid diarrhoeal stool from 2nd POD most likely due to ischaemic colitis. It was managed with ORS and IV fluids with addition of metronidazole, with spontaneous resolution over 3-4 days. The patient was fully oriented, mobile and was taking orally when he was discharged on 10th POD. F/U: On follow up after 1 month and 6 months of operation, his B.P. was 120/80 mmHg and all the pulses were palpable except left dorsalis pedis. His wound was good and there was no lump or bruit per abdomen.

Discussion:

The most dreaded complication of AAA is the rupture and ironically the natural history of AAA is to enlarge and rupture. The single most important factor associated with rupture is maximal cross-sectional aneurysm diameter. Aneurysms enlarge at an average rate of 0.4 cm per year with a higher individual variability (2). The risk of rupture is estimated at 1-3% per year for aneurysms 4 to 5 cm, 6-11 % per year for 5 to 7 cm aneurysms and 20% per year for aneurysms greater than 7cm (2). Aneurysms smaller than 4 cm appear to be at a very low risk of rupture. Arterial hypertension and COPD increase the risk of rupture. Here in our patient, we do not know the size of the aneurysm before rupture though at operation the size was 8 cm and moreover he was a known hypertensive for quite a few years for which he was not taking medications. He was a smoker and had COPD also. Rupture of AAA can be either anterior or posterior. About 20% of AAA rupture are anterior (free intraperitoneal rupture) which causes immediate hemodynamic collapse and has a very high mortality rate (>90%). About 80% of AAA rupture are posterior (retroperitoneal) and are contained by psoas muscle and adjacent periaortic and perivertebral tissue because of which they may be hemodynamically stable at the time of presentation, and so they have a mortality figure of around 50% (3). Our patient was lucky to have a posterior retroperitoneal rupture and to survive for more than 48 hours before he presented fo us. Though he was in ARF and was disoriented, his blood pressure was relatively maintained when he presented to us.

The only treatment of ruptured AAA is immediate surgical repair. If the patient is in shock and has an expansile abdominal lump suggestive of ruptured AAA, the patient can be rushed to the operation theatre without doing any imaging investigations. The preferred approach is transperitoneal with either a midline or a transverse abdominal incision. We operated on this patient via transperitoneal approach by a midline abdominal incision. A' 16mm Dacron graft was used for the repair.

The survival statistics after rupture of an aortic aneurysm have not changed significantly since 1980s. Following rupture of an AAA, only 50% of patients arrive at the hospital alive. Of these, 24% of more die before surgery and 42% die after the operation, for an overall mortality rate of 78 to 94%. But mortality is 100% if not operated (4,5). The mode of death is usually due to multi organ dysfunction (MOD)(4). Our patient was a very high risk case due to very late presentation, acute renal failure with haematuria, disorientation and moreover he was a hypertensive as well as a COPD patient. On the one hand, with all this background there is always a hesitancy to operate on these patients while on the other he would have surely died if not operated.

In conclusion, it seems possible to salvage these difficult patients even in our setup, however early referral to an appropriate centre is necessary.

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The Story of Four Wives

A rich merchant had ***four wives.***

The merchant loved the fourth *wife*, the most of all. He adorned her with rich robes and treated her to delicacies. He took great care of her and gave her *nothing but the best'.*

He also loved the *third wife* very much. He was very proud of her and always wanted to *'show her off'* to his friends. However, the merchant always lived in great fear that she might run away with some other men.

He loved his *second wife* too. She was a very considerate person, always patient, and, in fact, was the merchant's confidante. Whenever the merchant faced some problems, he always turned to his second wife and she would always help him out and tide him through difficult times.

Now the merchant's *first wife* was a very loyal partner and had made great contributions in maintaining his wealth and business as well ', as taking care of the household. However, the merchant did not love the first wife. Moreover, although, she loved him deeply, he hardly took any notice of her.

One day, the merchant fell ill. Before long, he knew he was going to die soon. He thought of his luxurious life and he said to himself, "Now, I have four wives with me. However, when I die, I will be alone. How lonely I will be!"

And so, he asked the fourth wife, "I loved you the most, endowed you with the finest clothing and showered great care over you. Now that I am dying, will you follow me and keep me company?"

"No way!" replied the fourth wife and she walked away without another word. The answer cut like a sharp knife right into the merchant's heart.

The sad merchant then asked the third wife, "I have loved you so much through all my life. Now that I am dying, will you follow me and keep me company?"

"No!" replied the third wife. `Life is so good over here! I'm going to remarry, when you die!!" The merchant's heart sank and turned cold.

He then asked the second wife, 'I always turned to you for help and you've always helped me out. Now I need your help again. When I die, will you follow me and keep me company?"

"I'm sorry, I can't help you out this time!" replied the second wife. "At the very most, I can only send you to your grave!!" The answer came like a bolt of thunder and the merchant was devastated.

Then a voice called out: "I'll live with you. I'll follow you no matter where you go... " The merchant looked up and there was this first wife. She was so skinny, it seemed almost as if she suffered from malnutrition. Greatly grieved, the merchant said, "I should have taken much better care of you while I could have!"

There is a "moral" to this story:

Actually, we all have **four wives** in our lives...

The fourth wife is our body. No matter how much time and effort we lavish in making it look good, it will leave us when we die. Our third wife? Our possessions, status and wealth. When we die they all go to others. We cannot take them with us.

The second wife is our family and friends. No matter how close they have been to us when we were alive, the furthest they can stay by us, is up to the grave.

The first wife is, in fact, our soul, often neglected in our pursuit of material wealth and sensual pleasure. Guess what? It is, actually, **the only thing that follows us wherever we go.**

Perhaps, it is a good idea to cultivate and strengthen it now, rather than wait until we are on our deathbed and lament.

Cardiovascular Disease Pattern of Admitted Cases In Medical Ward in 2002 At SGNHC

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Introduction:

Cardiovascular disease accounts for nearly half of all deaths in developed countries. In developing countries, though communicable diseases still possess the major threat, cardiovascular diseases are rising at an alarming rate. About a quarter of total annual death is caused by cardiovascular disease in developing world. Rheumatic heart disease is considered "disease of the poor" and is already a big burden in developing countries. But the markedly increased incidence of coronary artery disease in these recent years has alarmed the health care professionals of developing countries. Increasing trend of cardiovascular mortality and morbidity and changing pattern of cardiovascular disease have forced us to look into this matter more seriously.

Since the opening of indoor services in Shahid Gangalal National Heart Centre in May 2000, we have been closely evaluating the admission pattern in medical ward. It has revealed interesting information.

Methods:

Disease pattern of total 1054 cases, admitted in medical ward from 1st Jan to 31st Dec 2002, were studied retrospectively from the hospital admission book. Proportionate distribution of disease pattern of admitted case was calculated and data compared with figures of previous years.

Results:

Total 1054 cases, (Mean Age 55 yrs. Range 6-96 yrs.) including 611 (58%) male and 443 (42%) female were investigated. The number of IHD cases was the highest, altogether417, which was 39.5% of total admission. IHD was respectively followed by RHD (20.8%) and Essential Hypertension (9.6%). 6.8% of patients admitted had congenital heart disease, including TOF, VSD, ASD, PDA and coarctation of aorta. 6.5% were diagnosed as Idiopathic DCM. 2.2% of patients had COPD-cor pulmonale. 1.9% patients had Infective endocarditis, among which, 15 had RHD and 5 had CHD as underlying heart problem. Altogether 14 patients (1.3%) were admitted with either pericarditis or pericardial effusion. Among cardiac arrhythmias, 17 patients (1.6%) had complete heart block and 8 patients (0.8%) had Sinus node dysfunction. 18 patients (1.8%) were admitted

with tachyarrhythmias like PSVT, VT and Non-Valvular Atrial fibrillation. Relatively not-so-common diseases like Restrictive cardiomyopathy (1). Primary PAH (3, all female), Aortic dissection (1). Aortic aneurysm (2), Takayasu disease (2), Hypertension with Renal Artery Stenosis (3) were also seen in 2002.

Total mortality was 23 (M=8, F=15), which is 2.2%. Majority of the patient, who died in general ward, were suffering from Rheumatic heart disease.

Table1: Disease Distribution of Cases admitted in medical ward in 2002.

Diseas	Male	Female	Total	%
Ischemic Heart Disease	293	124	417	39.5
Rheumatic Heart Disease	86	134	220	20.8
Hypertension	59	43	102	9.6
Dilated cardiomyopathy	44	24	68	6.5
Congenital Heart Disease	38	34	72	6.8
COPD-Cor pulmonale	10	13	23	2.2
Infective Endocarditis	15	5	20	1.9
Arrhythmia	25	18	43	4.2
Others	41	48	89	8.7
Total	611	443	1054	100%

Discussion:

Ischemic heart disease was the commenest cause of admission in 2002, leaving Rheumatic heart disease far behind (39.5% Vs 20.8%). Three years back, Rheumatic heart disease was the most common cause of admission in SGNHC, followed by IHD an Hypertension. Last year 26.5% of admitted patients had IHD and 25.9% had RHD. This gives us a clear message that the incidence and prevalence rate of IHD is rising at an alarming rate. In-patients records of cardiac admissions in major hospitals also support the impression of on-going epidemic of Ischemic heart disease in our part of the world, which is already burdened with Rheumatic heart disease. Among 417 IHD patients, about 70% were male and 30% female where as in Rheumatic heart disease, there was female preponderance (60% vs 40%). Prevalance of Hypertension is more common than IHD or RHD in general population but only those with severe Hypertension or Hypertensive Urgency/Emergency are admitted. Hence, Hypertension became the third common cause of admission, male, female ratio being 1.4:1. Among the congenital heart disease, Tetralogy of Fallot was number one cause of admission in medical ward, followed by VSD, ASD and PDA. That is because patients with relatively more common but simpler congenital problems are either managed in OPD or they can easily go for surgical repair. The admission no. of COPD Cor- pulmonale has reduced from 7% to 2% in the last three years.

It is mainly due to encouragement to such patients to receive treatment in general hospitals with strong Respiratory division or Internal medicine department. In conclusion, this study provides the information about the disease pattern and common diseases of cardiovascular system in our country. Ischemic heart disease, Rheumatic heart disease and Hypertension are the most common cardiovascular diseases in Nepal.

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Study of normal ECGs of healthy Nepalese medical personals without any apparent medical illness.

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Abstract:

Objective: To find the normal electrocardiographic duration, intervals, and axis in a healthy group of Nepalese doctors, nurses and medical representatives and to see if these figures differ from the standard values described in the textbooks and literature.

Setting: cardiology unit of Bir hospital, a national postgraduate referral hospital and part of National Academy of Medical Sciences.

Methodology: All the participants were told and consented for the study. Total of 101 participants took part in the study including 65 male and 36 female participants .ECG was taken at cardiology outpatient department (OPD) of Bir hospital for a week with help of a trained ECG technician by using portable Cardimax ECG machine. Electrocardiographic duration, intervals and axis were measured and compared with the standard value.

Results: All electrocardiographic duration and intervals derived from the present study including p wave, QRS, Tand PQ, QT and QTc were within normal limits as is described in the literature with minor variations.

Conclusion: Though all ECG parameters were within normal limits minor ECG variations should be taken into account while interpreting electrocardiograms in Nepalese population.

Key words: normal ECG, healthy Nepalese Medical Personnel, and Katmandu, Nepal

Introduction:

Electrocardiogram also known as ECG or EKG (from German word) is a

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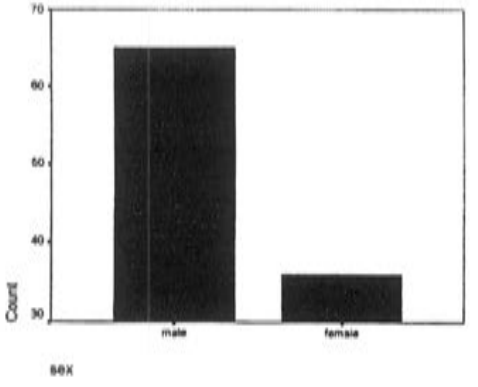
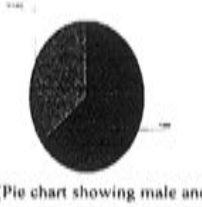
recording of the electrical activity of the heart (1) by placing specific electrodes at different specific locations of the body. This is one of the oldest cardiac investigative tools still practiced successfully throughout the world. Even after so many years of its use many significance is still becoming apparent. People of different ethnic backgrounds and people of different age and sex have got different lifestyle and socioeconomic standards that might influence the electrocardiographic measurements (2). Some normal ECG changes specifically seen in females may not seen in males and similarly some nonspecific changes might be seen in apparently normal individuals. There was one similar study (2) done in Nepalese doctors but it included few doctors only in its study so we decided to conduct a broader study including male and female of different ages to see normal individual variability of ECG parameters and its mean in the studied population and the value was compared with standard value described in the literature

Methodology:

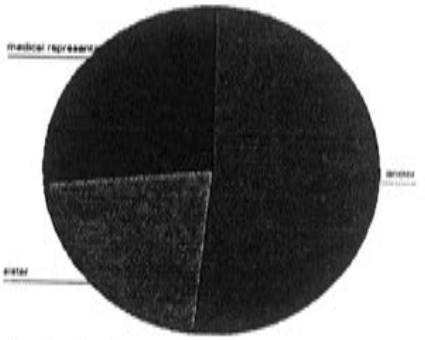
All the participants were told verbally and consented for the study. Total of 101 participants took part in the study including 65 male and 36 female participants. Medical doctors, sisters, staff nurses and medical representative between the ages of 17 and 40 years were included in the study. Those not having medical illness especially cardiac disease and not taking any medicine including those of B blockers, anxiolytic and antihistamines were included. Before taking ECG history about medical illness was taken and they were told to take at least 15 minutes of rest. ECG was taken at cardiology outpatient department (OPD) of Bir hospital for a week with help of a trained ECG technician by using portable Cardimax ECG machine. 12 lead ECG at the speed of 25 mm/sec were recorded with proper standardization and amplitude of 25 mm/millivolt and a minimum of four ECG complexes were recorded with long rhythm strips. Electrocardiographic duration, intervals and axis were measured (3) with the help of ruler; caliper, protracter and mean value of at least four complexes were taken which was verified by independent cardiologists and compared with the standard value.

(Bar diagram showing male and female)





(Pie chart showing male and female)



Pie chart showing different study populations)

Result:

The final result of the study is tabulated below.

Table (1)

	Male (N =65)			Female (N = 36)			Combined (N =101)		
	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean (±SD)
Age (years)	39	22	28.46	32	17	23.62	39	17	26.04 ± 4.81
R-R interval (milli sec)	1133	497	817	1086	528	762	1109.5	512.5	789.5±14.51
Heart rate (millisec)	121	53	73	114	55	79	121	53	76.29±12.04
P wave (millisec)	110	52	83	105	60	81	110	52	81.31± 10.93
PQ interval (millisec)	180	100	144	176	85	139	180	85	142.06±19.41
QRS duration (millisec)	90	40	63.81	80	40	60.62	90	40	62.01±13.15
T wave (millisec)	188	95	144.07	173	110	136.58	188	95	142.79±17.44
QT interval (millisec)	405	280	329.37	400	288	336.63	405	280	331.96±27.12
QTc interval (millisec)	439	299	366.13	459	355	386.72	459	299	374.36±26.03
P wave axis	90	0	51.92	60	0	46.52	90	0	49.11±19.36
QRS Axis	90	-15	52.82	90	15	56	90	-15	54.07±21.99
T wave axis	90	0	39.46	60	0	43.19	90	0	40.84±21.24

Out of 101 patients studied males were 65 and females numbered 36 with a mean age range of 28.46 and 23.62 years respectively. The maximum age of male subject was 39 years and minimum was 22while that of female was 32 and 17 years. Maximum RR interval of 1133 and minimum of 817 millisec was observed in males with max heart rate of 121 and minimum of 53 while it was 1086millisec and 528 millisec yielding heart rate of 114 as max and 55 as minimum in females. Values of P wave observed were 110 millisec as max and 52 millisec as minimum in males while the figures were 105 and 60 millisec in females. Mean PQ interval was 144 millisec in males with maximum value of 180 millisec and minimum value of 100 millisec while the similar values were 176 and 85 millisec with mean value of 139 millisec in females. QRS duration ranged from 40-to90 millisec with mean value of 63.81 millisec in males and 40 to 80 millisec with mean value of 60.62 millisec in females. T wave ranged from 95 to 188 millisec with mean value of 144.07 millisec in males while the similar values were 110 and 173 millisec with mean value of 136.58 millisec in females. Males had maximum QT interval of 405 millisec and minimum of 280 millisec with mean value of 329.37and the corresponding values in females were 400 and 288 millisec with mean value of 386.72 millisec. Corrected QT (QTc) ranged from 299 to 439 millisec in males with mean value of 366.13 and the same value in females were 355 to 459 millisec with mean value of 386.72 millisec. Similarly P, QRS and T wave axes spread from 90 to 0, -15and 0 degree respectively with the corresponding mean value of 51.92^{0}, 52.82^{0}, and 39.46^{0}, while in females they were 60,90,and60 degrees to 0,15 and 0 degrees with mean values of 46.52,56 and 43.19 degrees.

According to the literature normal P wave duration is 60-100 millisec and normal amplitude is less than 2.5 millimeter. In our study mean P wave was 83 and 81 millisec in males and females respectively, but the maximum and minimum value exceeded in males and max value in females so the difference was not significant.(1,2,3)

The normal PQ interval is 120-220 millisec in literature, which in our study was 144and 139 millisec in males and females respectively with max and minimum value of 180-100millisec in males and 176-85 millisec in females respectively, thus being well within the normal range. (1,2,3)

Normal duration of QRS complex is usually 50-100 millisec, which in our study was 63.81 and 60.62 in males and females respectively with max to min range being 90-40 and 80-40 respectively.(1,2,3)

T waves are usually not more than 5 millimeter in any standard leads and 10 millimeter in any precordial leads which in our study were144.07and 136.58 millisec in males and females respectively.

The normal range of QTc is from 350-430 millisec, which in our study was 366.13 and 386.72 millisec in males and females.(1)

The normal mean manifest frontal plane P wave axis is directed within 40 to 60 degrees which in our study were51.92 and 46.52 degrees in males and females respectively. Similarly QRS and T wave axes along with QRS-T angle were not significantly different from the described value in the literature.(1)

The findings of the study are being compared in table (2) with similar studies findings done by Dr DB Karki and Dr Sudhir lohani in table 3,4,and 5. [2]

Table (2)

	Max	Min	Mean (±SD)
Age (years)	39	17	26.04 ±4.81
R-R interval (milli sec)	1109.5	512.5	789.5±14.51
Heart rate (millisec)	121	53	76.29±12.04
P wave (millisec)	110	52	81.31±10.93
PQ interval (millisec)	180	85	142.06±19.41
QRS duration (millisec)	90	40	62.01±13.15
T wave (millisec)	188	95	142.79±17.44
QT interval (millisec)	405	280	331.96±27.12
QTc interval (millisec)	459	299	374.36±26.03
P wave axis	90	0	49.11±19.36
QRS Axis	90	-15	54.07±21.99
T wave axis	90	0	40.84±21.24

ECG intervals in millisec (Table3), Kari, DB, Lohani, L

Intervals	RR	PQ	QT	QTc
Maximum	1230	178	442	462
Minimum	650	116	322	365
Mean	800.97	148	359.94	403.61

ECG axis in degree (Table4) Kari, DB, Lohani, L

Axis	P	QRS	T
Maximum	75	101	76
Minimum	21	-102	0
Mean	54.34	54.16	40.23

(ECG duration in millisec) (Table 5) DB Karki, S Lohani

Duration	P	QRS	T	HR
Maximum	122	104	348	92
Minimum	90	74	248	50
Mean	104.69	87.68	246.39	76.42

This comparison shows that P wave duration was well within the normal values in our study as compared to that of the previous study. RR interval, heart rate, and PQ were not significantly different. QRS duration, QT and QTc though different were not statistically significant from those described in the literature. P, QRS and T wave axes were similar and the difference is insignificant.

Statistical analysis: Maximum, minimum, mean values and standard deviation was calculated and their significance checked with the standard values described in the literature and with that of the previous study done in Nepal. Statistical analysis package program SPSS8.0 was utilized for analysis.

Discussion& Conclusion:

Einthoven, using an improved electrometer and a correction formula developed independently of Burch, distinguished five deflections, which he named P, Q, R, S and T.

The four deflections prior to the correction formula were labelled ABCD and the 5 derived deflections were labelled PQRST. The choice of P was a mathematical convention by using letters from the second half of the alphabet. N had other meanings in mathematics and O was used for the origin of the Cartesian coordinates. In fact Einthoven used O..... X to mark the timeline on his diagrams. P is simply the next letter.

Einthoven invented a new galvanometer for producing electrocardiograms using a fine quartz string coated in silver based on ideas by Deprez and d'Arsonval (who used a wire coil). His "string galvanometer" weighed 600 pounds.(6,7)

In**1902**Einthoven published the first electrocardiogram recorded on a string galvanometer. In1903 Einthoven discussed commercial production of a string galvanometer with Max Edelmann of Munich and Horace Darwin of Cambridge Scientific Instruments Company of London. Cambridge scientific company produced the first commercial machine in 1911in England. Later many advancements and modification were done before we finally have very light and portable machines.

In**1942**Emanuel Goldberger increased the voltage of Wilson's unipolar leads by 50% and created the augmented limb leads aVR, aVL and aVF. When added to Einthoven's three limb leads and the six chest leads we arrive at the 12-lead electrocardiogram that is used today.

Later Arthur Master could utilize it for exercise test for cardiac function in**1942.** (8)

Later different significant findings were discovered using ECG as an investigative tool in cardiology that is still being used today. There are interesting findings and correlation of ECG findings with different conditions. (9,10,11) Even so different lifestyles and body habitus can have some different ECG findings for which this study was done.

This study highlighted that all the ECG parameters in the Nepalese population were within normal range including that of P wave and QRS duration, which after Karki and Iohani's study were thought to be on the higher side. However some individual values exceeded from that described in the literature so such values should be understood while evaluating electrocardiograms of Nepalese population.

Acknowledgement:

We would like to thank to all those doctors, nurses and medical representatives who voluntarily participated in the study. Our special thanks to Dr Sanjay Shrestha for statistical analysis and Mrs. Ansuka Rajopadhayaya and Anita Shrestha for taking all those ECGs.

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Percutaneous Transvenous Mitral Commissurotomy in SGNHC

Dr Rajib Rajbhandari, Dr Man Bahadur K.C, Dr Rabi Malla, Dr Deewakar Sharma Dr Y R Limbu, Dr Sujib Rajbhandari, Dr Shyam Regmi, Dr Bhagwan Koirala& Dr N K Shrestha

Percutaneous transvenous mitral commissurotomy(PTMC) is the procedure to dilate the narrowed mitral valve(usually rheumatic mitral stenosis)by specially made balloon. With good case selection, PTMC is a safer procedure compared to surgical closed mitral commissurotomy(CMC). CMC involves general anaesthesia, opening of chest wall and substantial morbidity with long hospital stay. In comparision , PTMC is done under local anaesthesia without opening chest wall and patient can be discharged the next day. To the date 32 patients have undergone PTMC in SGNHC; this includes one pregnant case. Severe bicommissural calcification and mitral regurgitation of grade more than 2 were excluded. There was significant increase in mitral valve area and decrease in mean left atrial pressure. Also there was marked symptomatic relief immediately after the procedure. With good case selection the results are good and safe. It is hoped that in near future this procedure will replace CMC surgery in SGNHC.

Prevalance of rheumatic and congenital heart disease in school children of Kathmandu

Dr Man Bahadur KC

Rheumatic heart disease (R.H.D} remains a major public health problem in all the developing countries through out the world. The prevalence of {R.H.D} among school children varies from 1.36 to 6.4 per thousand in developing countries and Nepal is not exception where the prevalence of R.H.D shall be significantly higher like other developing nation. Congenital heart disease {C.H.D} is also a major cause of morbidity and mortality in school children, of which, till the date no single study was performed. The study included 9420 students from 7 public schools of Kathmandu, of which 4466 were male and 4,954 were female. The age ranged from 5 to 18 years and the mean age was 12.73 -+ 3.33 years. In clinical survey, the selected schools were visited by a team of doctors, consisting of three to five resident doctors and one cardiologist. All the children were requested to fill up a performa prior to visit of the examining team. T he pefrorma included demography, birth place, and current residential address, number of family members, family background and history of past illeness {symptoms, sign, duration, recurrence and treatment} All children attending on the visit day were examined by members of the team focussing on cardiac examination. Children suspected of having heart disease or history of rheumatic fever {R.F} were further evaluated by cardiologist and reffered to Shahid gangal national heart center. In hospital, children were subjected to chest X-ray, electrocardiogram and echocardiogram {M-mode, 2D, Color Doppler, CW, PW, CFW, ALOKA, and SSD-5500, JAPAN}. According to clinical evaluation {history, physical examination and investigation} children who proved to be free from heart disease were excluded

from the study and those with confirmed heart disease were classified into either RHD group or CHD group. RHD was confirmed on the basis of either previous history of rheumatic fever and echocardiographic finding or both. CHD was confirmed on the basis of clinical findings {HISTORY OF ILLNESS SINCE EARLY INFANCY OR CHILDHOOD, CHARACTERISTIC MURMURS, CXR AND ECG} and echocardiographic findings. Conclusion, The prevalence of RHD in school children is 117/1000,ooo and the prevalence of CHD is 127/100,000. & The prevalence of RHD in school children is significantly higher than that of developed countries. In RHD group, no female predominance was observed; on the contrary the number of male patients were two times higher than female patient. Mitral regurgitation was the most common lesion followed by mitral stenosis, and then aortic regurgitation. In CHD group, there was female predominance ASD was the most common lesion followed by VSD and PDA

Early extubation of patients after open heart surgery at Sahid Gangalal National Heart Center, Bansbari, Kathmandu.

Dr. J. N. Pokharel, Dr. M. Uprety, SGNHC

Extubation of the patients after open-heart surgery is a major issue around the world. Some centers practice an early extubation and others prefer a bit prolonged ventilation in the post-operative period. We have assessed one hundred and sixty consequitive patient after open-heart surgery for extubation time in the post-operative period in our center. The average extubation time was 4.1 hours and paediatric patients were extubated at 2.9 hours. On separate assessment for the separate pathological conditions, patients with congenital heart disease were extubated at 4.1 hours, valve surgeries at 6.2 hours and others were at 4 hours.In conclusion our extubation trend is towards an early extubation period.

Preliminary report of head up tilt testing for evaluation of syncope

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Head of tilt testing is a recognised method for evaluation of syncope; it is used for replication of symptoms in persons complaining of vertigo and syncope. The symptoms of neurocardiogenic syncope and hypersensitive carotid sinus can be reproduced by this procedure. We have used this simple test for evaluation of patients complaining of unexplained syncope. All the patients attending the OPD with the complaints of unexplained syncope and vertigo have been included in the study. A total of 13 cases were studied during September 2002 –December 2002. Out of 13 cases 4 are negative for provocable syncope and 3 are hypersessetive carotid sinus and rest 6 are neurocardiogenic syncope. Head up tilt testing is a useful method for evaluation of neurocardiogenic syncope.

Pharmacological Cardioversion Of Atrial Fibrillation In Nepalese Population

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Norvic - Escorts Health Care and Research Centre, Kathmandu, Nepal

Background: Intravenous Procainamide and Oral Flecainide are often used for cardioversion of Paroxysmal Atrial Fibrillation (AF). Hypertensive patients may have problems of proarrythmias with these agents and Intravenous Amiodarone may be an effective and safer alternative. The utility of Intravenous Amiodarone in such group of patients in the Himalayan kingdom of Nepal has never been assessed. Methods: 76 patients with hypertension and non-valvular Atrial Fibrillation lasting for more than 24 hours were admitted for pharmacological cardioversion. Patients with valvular heart disease, cor-pulmonale, acute coronary event, left ventricular ejection fraction of less than 40%, and AF with slow ventricular rate were excluded. Patients with AF duration more than 48 hours or with AF of uncertain age were given a prior three weeks of anticoagulation. Intravenous amiodarone was given in the loading dosage of 15mg/min over 10 minutes, followed by 1mg/min in the next 6 hours & maintained at 0.5 mg/min for the next 42 hours. Elective electrical cardioversion was planned if patient was still in AF at the end of 48 hours. Results: 54%(41 out of 76) of overall patients & 70%(32 out of 46) of the patients with AF of less than 48 hours duration reverted to normal sinus rhythm within 48 hours of intravenous amiodarone. 30%(23 out of 76) patients were reverted with electrical cardioversion. None of the patients had any untoward effects of amiodarone. All the patients were discharged on the third day. Conclusion: Intravenous amiodarone is a safe & effective method of pharmacological cardioversion of AF in hypertensive patients particularly if it is of less than 48 hours duration.

Heartfile

PREVENTING CORONARY HEART DISEASE In South Asia

SAARC Cardiac Society Guidelines and Recommendations

Sania Nishtar

The South Asian Association for Regional Cooperation (SAARC) was established in 1985 at the First SAARC Summit held in Dhaka, Bangladesh, even though ideas for regional grouping of South Asian nations had been mooted since 1980. Currently made up of Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka, SAARC's main goal is to accelerate economic and social development in member states through joint action in certain agreed areas of cooperation. The SAARC Cardiac Society is an official affiliate of the SAARC framework with the overall objective of fostering cooperation between member countries in the area of cardiovascular disease control. The development of these clinical guidelines and recommendations is part of this initiative.

PREFACE

South Asia, housing more than half of the worlds poor and illiterate and constituting 23% of the world's population is a notable reality in the face of the cardiovascular disease epidemic. The meager per capita average budgetary expenditure on health ranging between US $ 11-20[1] for different countries of the region further highlights this challenge. The prevention and control of cardiovascular diseases is therefore one of the major health care issues faced by South Asia; the fact that this remains largely unrecognized adds to the gravity of the situation. Cardiovascular diseases are low on the list of priorities in these countries where reproductive and communicable disease issues dominate health care; the economic impact of these diseases and its implications for disadvantaged groups also remains largely unrecognized. A significant lack of awareness about the magnitude of the problem at all levels and a consequent lack of will to address this issue is therefore likely to have serious implications.

In order to address this issue effectively in the South Asian context several simultaneous approaches at the policy and program level need to be set into action as a priority. Major challenges at the policy level are anticipated, but counters to those exist; several opportunities also exist at the program level, which have the potential to integrate the preventive approach to cardiovascular diseases with the current health agendas in these countries in a time and cost efficient manner; an attempt has been made to identify these. In addition, several considerations unique to the South Asian setting need to be recognized and addressed at the professional level in a public health and clinical framework.

These considerations call for the formulation of recommendations and guidelines at all levels for the prevention of cardiovascular diseases in the region. The need to formulate these guidelines and recommendations is made even more urgent as disease prevention and health promotion are the

only affordable solutions for the vast populations of South Asia. Classical medical interventions are, and will continue to remain, inaccessible to the majority of the population in the short to medium term. The compelling driving force behind this approach is the understanding that South Asia cannot afford a full-blown CVD epidemic. We therefore must do all that we can to prevent it.

This document presents recommendations and clinical guidelines for the prevention and management of coronary heart disease, which is the principal preventable cardiovascular disease. However it must be recognized that all major preventable cardiovascular diseases and indeed many other non-communicable diseases are linked by common preventable risk factors and can be addressed through a common preventive strategy.

I am very grateful to all the members of the SAARC and the Regional Consensus Panels for their valuable input and members of the International Advisory Board for their guidance. I also wish to take this opportunity to thank especially, members of my team at Heartfile: Dr. Saulat Yar Khan, Yasir Abbas Mirza, Dr. Yasmin Hadi and Dr. Asma Badar for all the support that they lent me for this task and lastly my especial thanks to Prof. Upendra Kaul, Secretary General of the SAARC Cardiac Society for his help and encouragement all through the preparation of these guidelines.

Islamabad, Pakistan
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CORONARY HEART DISEASE PREVENTION GUIDELINES AND RECOMMENDATIONS FOR THE SAARC REGION

Guidelines are systematically developed statements traditionally used to reinforce best practices.[2] The principal benefit of guidelines is to improve the quality of care received by patients. Guidelines can also be seen as a way to support effective clinical practice adaptable in individual circumstances and additionally serve as educational tools.[3]

The broad interest in clinical guidelines has its origin in issues that health care systems face the world over. These include rising health care costs fueled by increased demand for care, more expensive technologies and an ageing population; variations in service delivery among providers, hospitals and geographic regions; the presumption that at least some of the variation stems from inappropriate care, either overuse or under use of services and the intrinsic desire of healthcare professionals to offer, and of patients to receive, the best care possible.[4] In South Asia, developing clinical guidelines to optimize health care delivery is a major challenge as the level of care varies dramatically from place to place. The thickly populated urban areas are technologically advanced while the rural areas often fall short of the bare minimum of health care provision.

Several guidelines within the framework of primary and secondary prevention of coronary heart disease (CHD) have been developed as part of an effort to standardize practice in the developed world, drawing recommendations based on outcome data from randomized clinical trials;[5] some of these guidelines have also graded recommendations based on the levels of evidence.[6] Such guidelines have been guiding clinical practice in the region but are unable to address issues relating to cost of care and unavailability of options. Therefore, their impact on clinical practice is limited. It is with this perspective and needs assessment that guidelines for preventing CHD in the South Asia have been developed. Guidelines for South Asia can be appropriately targeted to a population belonging to the

same ethnic group, sharing cultural similarities, geographic proximity, economic priorities, and similar epidemiological characteristics of cardiovascular disease.[7] This need was emphasized upon at the executive council meeting of the SAARC Cardiac Society in July 2000, where it was proposed that a series of practice guidelines be formulated for the region through consensus amongst member countries. The first in this series are guidelines for the prevention of CHD in South Asia.

In addition to clinical guidelines, this documents also addresses key public health and policy issues specific to South Asia and summarizes public health and policy recommendations that have been identified as being crucial to the preventive approach to CHD in the region. Prevention of CHD has been categorized under primordial, primary and secondary, employing both behavioral and drug interventions with recommended goals. Tertiary prevention has not been dealt with. Recommendations highlight the public health and clinical approaches, with considerable overlap. Key policy issues relating to heart disease prevention have been alluded to in an attempt to sensitize clinicians to the crucial relevance of policy changes in the larger perspective of *Cardiovascular disease prevention.*

THE GLOBAL BURDEN OF CARDIOVASCULAR DISEASE

Cardiovascular disease has probably been the worlds leading cause of death for at least the last two decades of the 20th century.[8] In the year 1999, 16,970,000 people died due to cardiovascular diseases the world over, which accounts for 30.3% of all the deaths worldwide.[9] Cardiovascular diseases additionally account for more than 10% of DALYs[1] in middle to lower income countries and 18% of DALYs in high-income countries. Within CVD, which account for about one in eight DALYs globally, ischaemic heart disease and cerebrovascular disease are the most significant.[10] In future, cardiovascular diseases are expected to become even more common with the aging of the world population.[11]

It has been estimated that non-communicable disease mortality will increase from 28.1 million deaths in 1990 to 49.7 million in 2020.[12] The top three contributors to the burden of disease in 2020 are predicted to be ischaemic heart disease, followed by unipolar depression and road-traffic accidents. This disease trend has been extrapolated from existing data based on what has been termed the *Epidemiological Transition*. This term was coined to describe the shift in the disease spectrum from communicable to non-communicable diseases. Previously communicable diseases and reproductive health issues were the overwhelming health concerns the world over, alongside nutritional deficiencies. Then as the industrialized world became developed these diseases were more or less brought under control and non-communicable diseases such as cancer, heart disease and stroke became a significant concern. Indeed, cardiovascular diseases make up the greater part of the non-communicable diseases. These diseases came in the wake of major demographic and lifestyle changes such as falling infant mortality, rising life expectancy, urbanization and increasing

[1] DALY is a way of measuring health status by quantifying not merely the number of deaths but the impact of premature death and disability on populations and combines them into the Disability-Adjusted Life Year or DALY.

gross national product and per capita income that were taking place in the developed world at the time, and have resulted in increased food consumption, tobacco usage and decreased physical activity.

This transition has already occurred in the developed world. The economies in transition are in the throes of the epidemiological transition and now it is the turn of the developing world. It is not widely realized that at present the developing countries contribute a greater share to the global burden of CVD than the developed countries and nothing less than an explosion in disease burden is projected over the coming years[13] termed as the impending global pandemic of cardiovascular diseases.[14]

PROFILE OF SOUTH ASIA

According to World Bank, a dollar a day estimates, out of the 1.3 billion people in the world who live below the poverty line, 515 million (40%) live in South Asia even though the region accounts for only 23% of the global population.[15] South Asia is one of the poorest, the most illiterate, the most malnourished, the least gender-sensitive, indeed, one of the most deprived regions in the world. This gap is also evident by comparing the South Asian GNP per capita (US $) of 437 to 1240 for the rest of the developing world.[16]

According to the Human Development Report in South Asia 1999,[17] the total estimated population of this region in 1998 was 1313 million people. With the total estimated population of the world at 6 billion, it can be seen that a sizable portion of humanity lives in the SAARC region. The annual population growth rate of South Asia is about 2% compared with 1.8% for the rest of the developing world. For this vast mass of mankind, the average public sector expenditure on health (as a percentage of the GDP) was 0.85 in 1997 compared to 2.0% for the rest of the developing world. Additionally for every dollar of central government expenditure spent on social sectors, $8.65 is spent on defense and debt servicing in Pakistan, and $3.12 in India, further highlighting the economic and political considerations that constrain the heath care scenario in the region.[17]

Cost is therefore a major issue in sustainability and compliance with any treatment, and is one of the major factors determining disease outcomes in the SAARC region.

Monthly household incomes in the rural and the urban areas of various South Asian countries and the percentages of the health expenditure borne by the private and the public sector have been tabulated (Table 1). All these figures highlight the constraints of the private and the public sector to invest in cardiovascular health care. This is further highlighted through a

***Table 1**[#] Average monthly household income and per-capita health expenditure in South Asian countries (US $)*

	Pakistan	India	Bangladesh	Nepal	Sri Lanka
Rural income	81,75	45,06	63,45	50,73	66,52
Urban income	110,13	53,32	138,30	74,77	133,04
Household size	6,70	5,60	5,00	5,10	5,50
Per person income (rural)	12,20	8,05	12,68	9,95	12,08
Per person income (urban)	16,43	9,52	27,65	14,66	24,18
Total per-capita health expenditure	18	20	12	11	26
% health expense (private sector)	77,5	84	52,78	76,36	54,84
Private sector per-capita health expense	13,95	16,8	6,33	8,4	14,26
% health expense (public sector)	22,5	16	47,22	23,64	45,16
Public sector per-capita health expense	4,05	3,2	5,67	2,6	11,74

comparison of the monthly expenditure on various therapeutic packages for the management of high blood pressure and lipid lowering with the annual rural and urban household incomes and when viewed as a percentage of the average household health expenditure by the private and the public sector (Appendix A).

With South Asia now on the verge of a cardiovascular explosion, its inability to invest meaningfully in therapeutic cardiovascular care is apparent. South Asia cannot afford to treat cardiovascular disease; therefore in addition to an emphasis on prevention, cost-effective clinical and public health approaches to the issue must evolve through consensus; these approaches should be based not only on evidence but also on the reality of what is feasible.

[#] Monthly household incomes and household sizes have been quoted from the Economic Reviews of the respective countries. Average monthly household incomes have been converted into US dollars based on the exchange rates as of July 18, 2001 displayed on http://theFinancial.com. Per capita health expenditure has been quoted from the World Bank Report: 2001, World Development Indicators, The World Bank, Washington 2001. Health expenditure and the percentages of the total health expenditure borne by the private and the public sector have been calculated from figures given in the same report.

EPIDEMIOLOGY OF CORONARY HEART DISEASE

South Asian Immigrant Population

An insight into the South Asian coronary risk comes from the study of the prevalence rates (mortality and morbidity data) amongst the expatriate South Asian population, which reveal that South Asians, as an ethnic entity have increased prevalence and definite evidence of excess mortality from CHD as compared to any other ethnic group.[18,19] This phenomenon was described initially for the colonial plantation workers in the Pacific islands in the early 1950's,[20] and was later confirmed by mortality and morbidity data from UK and USA,[21,22] and subsequently from other parts of the world.[23, 24,25,26,27] Similarly, recent data from Canada shows that being of South Asian ethnic origin carries 4.51 higher odds of CHD as compared to Europeans after adjusting for both conventional as well as novel risk factors.[28]

In addition to high prevalence, CHD is known to have a significantly younger onset and is known to be more aggressive in its presentation.[29] This excess CHD risk cannot be explained entirely in each South Asian sub group by conventional risk factors alone.[19,30] Data reveals that expatriate South Asians do however suffer from an increased risk of non-insulin dependent diabetes mellitus (NIDDM),[31] together with adverse fat distribution, hyperinsulinemia and insulin resistance relative to other ethnic groups.[32] This, known as the Insulin Resistance Syndrome is known to underlie the increased coronary risk in South Asian populations.[33] Alterations in body fat distribution particularly increased visceral fat may contribute to these abnormalities.[34,35] Insulin resistance has also been associated with inflammation;[36] C-reactive protein (CRP), which is a sensitive marker of systemic inflammation, has been shown to be higher in healthy Asian Indians than in European whites[37] and has been accounted for by greater central obesity and insulin resistance. This also highlights a possible mechanism for the increased coronary risk in this population. South Asians

are also known to have higher levels of triglycerides, lower HDL cholesterol (HDL) and relatively normal cholesterol levels as compared to Caucasians.[19,38,39] These may mediate atherogenic changes in the presence of relatively lower LDL cholesterol (LDL) levels reported for this population and raise the question of LDL lowering by amount or the utilization of triglycerides and HDL as primary goals for this population. Insulin resistance also increases small dense LDL particles, which may also contribute to the increased lipid related coronary risk in this population.[40] Further research is needed to clarify these issues.

For the expatriate population, the effect of migration on coronary risk is also important. Between countries comparisons (UK and India) have shown that migration confers a higher risk of CHD with an increase in body weight, serum cholesterol, and blood pressure. There is additionally a trend towards the acquisition of westernized behaviors consistent with a sedentary lifestyle, high salt and fat and low fiber diet and new stresses. The likelihood of increase in insulin resistance, its expression as frank diabetes mellitus and glucose intolerance probably increases on migration. A combination of these factors may therefore unmask the underlying genetic risk of CHD.[41]

The role of novel risk factors for CHD is now emerging; South Asians have also been reported to have higher homocysteine levels[42] and elevated PAI-1 and fibrinogen levels as compared to native white populations;[28,43] but there are, as yet, no clear answers to ascribe the increased coronary risk to a distinct risk profile. The risk factor profile of this population may also be continuously evolving as both the emigrant as well as the indigenous South Asian populations are undergoing rapid urbanization and acculturation of western lifestyles and behaviours, acting upon an, as yet unidentified susceptible genotype.

South Asian Indigenous Population

For preventive strategies the definition of the risk factor profile of a population to set targets for intervention and goals for preventative initiatives is crucial. For the South Asian population this has been complicated by several factors. Lessons learned from the expatriate coronary risk highlight increased mortality and morbidity trends that are partially unaccounted for by the traditional risk factor profile; the prevalence of traditional risk factors has not been well documented within the native populations; causal and

temporal relationships between the risk factors have not been established and against the backdrop of these current gaps in our knowledge, insufficient work has been done on the role of novel risk factors.

The public health response to this issue on one hand, must include health research that serves to inform policy and the subsequent initiation of preventive programmes. On the other hand, it demands, in synergism with the requirements for a concerted cost-effective clinical approach to this issue, a set of guidelines based on the currently existing level of knowledge. It may be true that the overall high CHD risk cannot be explained on the basis of these alone, but conventional risk factors for CHD such as smoking, high blood pressure, dyslipidaemia and diabetes are strongly associated with CHD in South Asians[44] and will remain the key if not the only elements of the risk factor model in this population. It is therefore prudent to set goals and targets for preventive initiatives based on the traditional risk factor profile; within this paradigm it is essential to emphasize targeting the risk characteristics that have been demonstrated as the key elements of the South Asian risk profile.

Several biological, behavioural, psychological and social risk factors have been recognized as risk factors for CHD; several aspects need to be recognized in this context. Firstly, the risk for most biological variables operates on a continuum of progressive increase over a wide range, rather than across abrupt arbitrary thresholds, which spells out the need to address the risk factor distribution in a population rather than deal only with those at the extreme high end. Secondly multiplicative risk arising from a combination of risk factors has also been recognized from several large longitudinal studies; it is now clear that the largest proportion of CVD events in any community arises from persons who have modest elevations of many risk factors than from individuals with marked elevation of a single risk factor. And thirdly clustering of CVD risk factors is also common due to similar life-style associations, which provides an opportunity to adopt integrated strategies of multi-factorial risk reduction.[14] There is therefore the need to address "risk profiles" rather than "a risk factor" with a potential for therapeutic intervention across a certain threshold.[45] The available sketchy data on the epidemiology of CHD in indigenous South Asians and its risk states is discussed.

Coronary heart disease: prevalence of CHD has been reported from India at 4% in the rural[46] and 11%[47] in the urban population whereas in Pakistan 7% of the population over the age of 65 years have reported to have been hospitalized for a myocardial infarction.[48]

Hypertension: the positive relationship between systolic and diastolic blood pressure and cardiovascular disease has long been recognized. In India, the prevalence of hypertension defined by JNC-V1 criteria has shown a steep increase from 6.2% in 1959[49] to 30.9% in 1995.[50] According to the National Health Survey of Pakistan,[51] hypertension (defined as a systolic blood pressure of over 140 and diastolic over 90 mm hg) affects 17.9% of adults 15 years of age and over and 33% of adults 45 years of age and over. Overall urban Pakistanis have higher prevalence of high blood pressure than rural dwellers (21.5% vs. 16.2%). The unawareness rate in this survey has been reported at 70%, which is amongst the highest in the world. Hypertension (defined as a diastolic blood pressure over 90) has a prevalence rate of 12.7% amongst females and 20% amongst males in Sri Lanka,[52] while in Bangladesh a prevalence of 11.3%[53] has been reported. In Bangladesh, the Household Expenditure Survey of 1995-1996 showed an average daily intake of 15 grams of salt,[54] which is far above the recommended levels and has significant implications for health promotion.

Smoking: smoking is the principal preventable risk factor for cardiovascular diseases and is now beginning to be recognized as a risk factor for atherothrombotic events.[55] Tobacco-use is highly prevalent in South Asia; tobacco is smoked in several forms such as in the hukka,[iii] beeri[iv] and cigarettes in addition to the practice of chewing tobacco in the form of "pan".[v] In both the urban and rural populations in India, tobacco use is widely prevalent. Studies have shown that 39% urban and 51% rural men in Rajasthan (India) either smoke or consume tobacco in some form.[56] In Pakistan 34% men and 12.5% women use some form of tobacco on a regular basis.[51] The prevalence of smoking in Sri Lanka has also reported to be high, ranging between 53-58% in the 35-59 years age group[57] while in Bangladesh 57% men and 23.2% women over the age of 18 years use tobacco.[58] The prevalence of smokeless chewable tobacco is very high in South Asia with over 10% of the population in Pakistan, 22% of men in India

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[iii] Device for smoking tobacco which is alike the middle eastern "hubble bubble"; tobacco is heated in a pot and is made to pass through water cisterns before being inhaled though a long tube; the device is used for communal smoking.

[iv] Beeri is a local form of cigarette in which tobacco is rolled in a leaf.

[v] Betel leaf eaten with condiments, which may include tobacco.

and 16% men and 21% women in Bangladesh[58] using chewable tobacco. The cardiovascular effects of chewable tobacco are similar to those of cigarette smoking.[59] However the age adjusted relative risk of dying from CVD is lower with smokeless tobacco than with tobacco smoking.[60]

Diabetes: diabetes mellitus is a major risk factor for CVD and is designated a CHD risk equivalent in Adult Treatment Panel III[61] (ATP III); compared with their non-diabetic counterparts, the relative risk for CHD for men with diabetes is two to three and that for women with diabetes is three to four.[62, 63,64] According to The National Health Survey of Pakistan,[51] defining diabetes as a random blood sugar of 140 mg% and over, there are 2.7 million people in Pakistan who may have diabetes, yet only 0.8% are diagnosed; prevalence being highest amongst obese urban dwellers. Urban females aged 45-64 years have the highest prevalence of diabetes at 18%, whereas rural females of the same age have a prevalence of 7%. Males aged 45-64 years have a prevalence of 9% in the urban and 5% in the rural areas. In India, the prevalence of diabetes has been variably reported at 1.3% to 2.4% in the rural and 3.0 to 8.4% in the urban areas.[65,66] In Sri Lanka, the prevalence is reported at 4.8% in males.[67] Studies in Bangladesh have shown that the age-standardized prevalence of impaired glucose tolerance is 7.7% whereas the prevalence of NIDDM has been reported at 4.5%.[68]

The Metabolic syndrome: the metabolic syndrome represents a constellation of lipid and non-lipid related risk factors of metabolic origin, recently a genetic basis for this has been hypothesized[69] and chronic sub-clinical inflammation has been reported as being part of this syndrome.[36] This syndrome is linked to the generalized metabolic disorder called insulin resistance in which the normal actions of insulin are impaired. Increased body fat (particularly abdominal obesity) and physical inactivity promote the development of insulin resistance.

Asian Indians are known to be more prone to central obesity, insulin resistance and glucose intolerance relative to other ethnic groups.[70,71] Abdominal obesity, a pattern of obesity as measured by waist circumference has emerged as an even more important risk factor for CHD than total body adiposity, and is more closely associated with cardiovascular disease risk factors studied than overall adiposity as measured by BMI.[72,73] A very high prevalence of waist hip ratio among men (0.95) and women (0.85) and

truncal obesity in both urban (men 39.1%, women 70.9%) as well as rural subjects (men 32.4%, women 42.3%) was reported from Delhi, India.[74] Recent studies have identified that the simultaneous measurements and interpretation of simple variables, such as waist circumference and fasting plasma triglycerides concentrations, could be used as inexpensive screening tools for the identification of men characterized by the athrogenic metabolic triad;[75] this may be particularly relevant in the South Asian context.

Generalized obesity and lack of physical activity: obese adults experience higher rates of CVD.[76] Obesity is often present in association with the other risk factors for CHD and this grouping further increases the risk. In Sri Lanka, 18.2% of the population was found to be obese (defined as BMI>24), whereas 20.9% of the population was labeled as leading a sedentary life.[77] A 10% prevalence rate of obesity amongst rural males and 20% amongst urban females has been reported from Pakistan.[51]

Individuals who engage in regular physical activity have lower prevalence rates of cardiovascular risk factors; exercise has also been found to yield beneficial effects on several risk factors and is therefore considered an important adjuvant therapy in risk factor modification.[78] For the South Asian population this offers a cost-effective opportunity for risk reduction.

Diet: it may seem that dietary practices vary in South Asia; diet in the North West Frontier province of Pakistan is rich in animal fat and red meat; in Sri Lanka food is predominantly cooked in coconut oil; in Bangladesh fish is the staple diet whereas in parts of India vegetarianism is the norm. The common element in these seemingly diverse dietary habits is the style of cooking, which is curry based and consumes a large quantity of fat. Additionally, with the trend of urbanization and acculturation of westernized lifestyles, there is an added concern relating to a diet even higher in salt, saturated fat and refined carbohydrates. Dietary modification for this population offers a great opportunity for risk factor intervention particularly since this can be packaged as a cost-effective approach. This is further reinforced by provocative evidence suggesting that a diet emphasizing more bread, more root and green vegetables, more fish, less beef and lamb replaced with poultry, no day without fruit, and substitution of butter and cream has effects that may be superior to those observed for the American Heart Association Step I diet.[79]

Dyslipidaemia: results of some studies from India have been consistent with a greater role for total and LDL cholesterol in mediating coronary risk[47] while results of others have revealed that coronary artery disease occurs in Indians at low lipid levels.[39] Recent unpublished data from the RISKCORN[vi] study in Pakistan also indicates that CHD occurs at relatively normal total cholesterol and LDL levels and indicates that CHD in this population is HDL rather than LDL driven. The evidence for the association between low HDL and CHD is quite strong; much of it derived from prospective epidemiological studies.[80,81,82] Recent meta-analysis of prospective studies show that elevated triglycerides are also an important independent risk factor of CVD whereas low HDL-cholesterol both modifies the goal for LDL lowering therapy and is used as a risk factor to estimate the 10-year risk for CAD in the ATP III guidelines.

Studies have also indicated that Lipoprotein(a) levels are elevated in people of South Asia origin;[41,83,84] however this needs to be interpreted with caution as the mechanisms by which Lp(a) is associated with CHD are not entirely clear; this is further complicated by lack of consensus on laboratory measurements of Lp(a). The atherogenecity of Lp(a) is reduced in association with reductions in LDL cholesterol levels. Indians are known to acquire higher LDL cholesterol concentrations compared to the native white population on migration, with a trend towards the acquisition of westernized behaviours; therefore the increases in serum cholesterol after migration may unmask the underlying genetic risk of CAD conferred by high serum Lpa.[41]

In India, the prevalence of hypercholesterolaemia (defined as >200 mg/dl), in the industrial, urban and rural populations in Delhi was reported at 30.9%, 36.8% and 16.3% respectively in men, and 21.7%, 39.7% and 16.3% in women. There were however, significant numbers with low HDL cholesterol, (<40 mg/dl) and high triglycerides (>150 mg/dl).[74] Serum cholesterol levels are reported to be over 6.5 mmol/l in 7.6% of rural and 14.9% of urban Sri Lankan population, and range between 5.2- 6.5 mmol/l in 27.9% of rural and 26.5% of the urban population respectively.[85] In Pakistan, 12.6% of the population over 15 years of age is reported to have serum cholesterol level over 200 mg/dl.[51]

[vi] A case-control study of the risk factors for coronary artery disease in a Pakistani population, Pakistan Institute of Medical Sciences, Islamabad, Pakistan and St Thomas hospital London, UK. Supported by the Pakistan Medical Research Council.

Stress: recent studies provide clear and convincing evidence that psychosocial factors contribute significantly to the pathogenesis and expression of CHD; this evidence is composed largely of data relating CHD risk to depression,[86] anxiety, personality factors and character traits such as anger,[87] social isolation, and chronic life stress.[88] Emotionally stressed younger patients are also known to represent high-risk groups.[89]

Expatriate South Asians have additional stresses in the host country related to social class, cultural isolation and racism in addition to the known risk factors for CHD operating in the host country; studies carried out on civil servants in UK have indicated that South Asians as compared to whites suffer from higher levels of stress; these findings are consistent with ethnic differences in coronary risk.[90] Native South Asians, however, may have a whole host of as yet poorly identified and measured psychosocial and economic stress factors.[91,92] Changes in the South Asian society such as urbanization, break down of family and social support systems, shift from a rural agrarian to a service and manufacturing economy while facing acute demographic and economic pressures are expected to increase both universal and culturally specific CVD stresses in future.[93]

Physical characteristics: low birth weight, thinness and short body length at birth are known to be associated with increased rates of cardiovascular disease and non-insulin dependent diabetes later in life.[94,95] Recently low birth weight is reported to be associated with endothelial dysfunction in young adults; an effect most marked in individuals with lower risk factor profiles and may be relevant to the pathogenesis of atherosclerosis in later life.[96] Data from India supports the high rates of CHD amongst those studied whose mothers had a low body weight during pregnancy. The highest prevalence of disease (20%) was in people who weighed 5.5 lb (2.5 kg) or less at birth and whose mothers weighed less than 100 lb (45 kg) in pregnancy.[97] The hypothesis needs to be further tested in the South Asian population.

Socioeconomic factors and social support: several studies have confirmed a graded, inverse relation between socioeconomic strata (SES) and the risk of CAD, CVD and all-cause mortality.[98,99,100] There is also an inverse relationship between SES and conventional risk factors.[101] Concurrence of risk factors; that can have a synergistic effect on the risk for CVD[102] has been shown to be higher in less educated groups.

Childhood poverty followed by high standards of living is known to operate at least partly as a risk factor of coronary heart disease though conventional risk factors.[103] Lower SES in childhood is associated with higher levels of hostility, depression and hopelessness; greater tobacco consumption and alcohol abuse; less leisure time physical activity; obesity and a less nutritious diet in adulthood.[104] Socioeconomic factors may be considered as important elements of the risk profile of this population in view of prevailing economic situation; there is potential to further explore this risk factor in the native South Asian setting.

Homocysteine: most of the data on homocysteine is representative of the developed world population, from which the diet of south Asians is known to differ appreciably. In Indian Asians as in other populations of Europe and North America moderately raised levels of plasma homocysteine are associated with an increase in the risk of coronary heart disease; plasma concentrations of homocysteine have been found to be raised in South Asians in comparison to the white population.[42,105] This difference could be explained on the basis of the lower vitamin B12 and folate levels in Asians. Reduced intake of vitamin B12 has been reported in Asian Indian women;[106] the prolonged cooking of vegetables, which is the common practice in many Asian Indian households, may destroy up to 90% of the folate content.[107] Knowledge of the fact that modification of dietary patterns can have substantial effects on fasting levels of total serum homocysteine opens new doors to evaluate this hypothesis in the South Asian population.[108]

Inflammation: several studies have addressed the possible role of infectious agents in the pathogenesis of atherosclerosis and CHD as a result of which many infectious agents have been implicated in the pathogenesis of CHD. Recently infectious burden has been correlated with CHD[109,110,111] and the simultaneous presence of antibodies has been shown to substantially increase the risk for disease development.[112] However, if general infective load is important then the relationship of micro-organisms to CHD in the subcontinent may be more complicated than that seen in temperate climates in the developed world. The hypothesis remains to be tested in the native South Asian population.

C-reactive protein, which is an independent risk factor for CHD has also been shown to be higher in healthy Asian Indians than in European whites

and has been accounted for by greater central obesity and insulin resistance.[113] Adiposity is also known to be a major determinant of CRP;[114] this highlights a possible mechanism for the increased coronary risk in this population.

Other risk factors: there are additionally several other risk factors studied in the developed world populations. A discussion of these is outside the scope of this document and is not relevant as there is not only no available data for the indigenous South Asian population on these risk factors, but in addition no significant potential for preventive intervention.

By and large, based on the existing level of knowledge, the South Asian coronary risk appears to be correlated with the insulin resistance/metabolic syndrome; it appears that this syndrome can mediate coronary risk even in the presence of relatively normal total and LDL cholesterol through low HDL cholesterol and high triglycerides. An inflammatory component of this syndrome may mediate part of this risk. Emerging data also supports a genetic basis of the insulin resistance syndrome.[115] It is pure speculation but in future it may be possible to demonstrate a genetic link between the insulin resistance syndrome and Lp(a), both of which are known to play a key role in the mediation of coronary risk in South Asians. Absence of data in these areas highlights serious gaps in our knowledge that need to be bridged in order to understand the increased CHD risk with important implications for prevention. It is therefore imperative to invest in the necessary infrastructure support and local capacity building for research to answer these questions.

THE CONTEXT AND FRAMEWORK OF CHD PREVENTION

Setting the preventive approach of CHD into action in a developing country setting requires the identification of locally relevant issues and existing opportunities for promoting cost and time efficient approaches to CHD prevention. While a preventive population-based approach is commonly acknowledged to be the most cost-effective, paradoxically most of the South Asian countries have adopted a high technology approach to the management of CHD. Technology-intensive management of CHD causes a massive diversion of resources and is unlikely to reduce the toll of CHD in our community. Indeed even the most advanced health systems in the industrial world cannot afford a high technology approach to the CHD epidemic and have turned to prevention-based approaches. Table 2 summarizes details of the cardiovascular resources available as an indication of the present tertiary care base in the region. Even though health systems in these countries have prioritized on tertiary care in CVD, it is evident from the figures that it falls short of the bare minimum. It needs to be additionally recognized that high technology tertiary care of CHD is usually centered on urban areas in South Asia and is accessible to a small minority of the population. This highlights the potential for increasing inequity in health access and outcomes between the haves and have-nots.

The course of the global CHD epidemic over the past 50 years has provided instructive lessons about the best approach to CHD. We know enough about CHD and its determinants that we can work for a future in which heart diseases and stroke could be largely eliminated.[116] Several biological, behavioural, psychological and social determinants have been recognized as risk factors for CHD. CHD prevention addresses many of these modifiable risk factors, especially lifestyle ones such as smoking, physical inactivity, high blood pressure, dyslipidaemia, obesity, diabetes and psychosocial stress. On the long-term, prevention also contributes to improving the polygenic tendencies which are also strong risk states for

***Table 2**[1] Cardiovascular health services in South Asia*

	Pakistan	India	Bangladesh	Nepal	Sri Lanka
Population (million)	141.55	1014	129.19	24.7	19.24
Cardiologists	384	2,500	110	44	14
Cardiac surgeons	19	15,00	25	7	9
Cardiology trainees	12	250	200	4	10
CV nurses	102	N/a	200	67	65
CV technicians	276	N/a	400	28	15
Cardiology departments	18	20	18	4	4
Cardiac surgery units	12	80	2	2	2
Catheter laboratories	13	160	2	1	2
Yearly catheter interventions	532	10,000	100	N/a	N/a
Open heart surgeries	3650	20,000	700	150	N/a

N/a: information not available

CHD. In populations who do not smoke, are not overweight, maintain a healthy diet and exercise moderately or vigorously for half an hour a day and consume alcohol moderately, the incidence of coronary events is more than 50% lower than that in the rest of the population.[1]

Investment in prevention is highly cost-effective; by controlling CHD risk factors in developed countries, the incidence and mortality rates of CHD have been dropping for years.[2,3] Similar trends have been reported from other developing countries[4] and the same can be expected for the South

Population data (in millions) has been quoted http://www.geographic.com. health service data has been taken from the White Book.

Asian population. In South Asia, as in several other developing countries, there is however, an urgency to prioritize prevention in view of the epidemiological trends of increasing CHD incidence and mortality[13] and the lack of resources to address these public health challenges.

Prevention of CHD before it occurs (primary prevention) needs to be coupled with prevention of complications and proper management once CHD has been established (secondary prevention). It is a priority to promote best practices on both levels of prevention. An important first step is to identify a set of guidelines to reinforce best practices or to encourage such practices by providing "recommendations" that local societies can use to develop guidelines to be used on the country or local level. Several recommendations and guidelines have been developed to guide preventive practices in the developed countries.[6,121,122] However such recommendations and guidelines may not be appropriate in the South Asian context. It is therefore imperative to develop culturally-specific and locally-relevant guidelines for the South Asian setting. The following section deals with the issues that are specific to South Asia with regard to CVD prevention and presents the rationale for the recommended approach.

Prevention paradigm

The prevention of cardiovascular diseases is more then a unidirectional initiative even for well developed health systems. The crucial participation of the communities in this effort entailing lifestyle changes; the behavioural, social, political and economic will to forge this change at the level of the individual, the community, the health system and the health policy maker and within that framework the need for health promotion, professional education and advocacy make CVD prevention a multidisciplinary approach involving the health system, industry, communication, trade, commerce, and taxation with implications for the national economy. These considerations have hampered the implementation of the ideal CVD prevention module in the best of circumstances even in the presence of provocative evidence that by investment in *the ideal prevention dose* the incidence of CVD can be dramatically reduced. This is complicated further by a lack of interest in prevention by the commercial and the industrial sector that have a direct interest in promoting curative care.

In developing regions such as in the case of South Asia, these considerations have greater implications in view of the limited resources and rising CHD trends. This needs to be recognized and warrants an urgent response both at the policy and the programme level to identify effective measures that hold the promise of early impact and to identify opportunities in the South Asian system that are conducive to this approach.

Fostering the political will

Even in the developed countries, there is a sense of complacency of CVD; several health issues of a lesser magnitude generate a far greater public health response as compared to CVD. This can largely be attributed to a lack of awareness at the policy level of the magnitude of the CVD issue. There are several dimensions of this lack of awareness, which translate into a lack of will to enact the appropriate measures. An understanding of these dimensions is crucial as it opens doors to means of time-efficient and locally relevant advocacy. Firstly, CVD is not identified with the health care priorities of the region, where a focus on communicable, nutritional and reproductive health issues has traditionally prevailed for decades. This is further complicated by the multilateral and bilateral donor polices which continue to prioritize on these issues. Whereas these health problems are an important part of the *unfinished health agenda* in poorer countries, lack of attention to non-communicable diseases (NCD), especially CVD, is bound to have grave implications. Secondly, prevention of major NCD is also not identified as being part of primary health care, whereas they qualify to be within that framework by any standard applied. These two issues need to be addressed at the policy level in order to make a significant headway.

A major opportunity in this context can be identified through the role that international health organizations, multilateral and bilateral donors and economic development agencies can play in setting the health care agendas in these countries. These organizations contribute a significant share towards the public sector health development expenditure; they have and will continue to play a major part in setting the health care priorities of developing countries. This opportunity has the potential to replace traditional advocacy time efficiently.

Synergism with development initiatives

Opportunities can also be identified in the framework of development initiatives in South Asian countries. These initiatives are driven largely by pro-poor policies and therefore it makes sense to highlight the economic impact of CVD. CVD has severe economic consequences that result from premature death and prolonged disability.[123] Study of the expatriate South Asian coronary risk has revealed that South Asians have a higher age-adjusted mortality as compared to Europeans.[124] It needs to be additionally recognized that CVD is not confined to the rich; while the affluent may be the first in developing countries to adopt deleterious lifestyles, and initially suffer high rates of CVD, in later phases, the epidemic rates are especially high in the poorest and least educated populations.[125] In addition, management of CVD requires significant out of pocket expenditures over prolonged periods of time. These expenditures are substantial when matched against household incomes with disastrous economic effects for poorer groups, especially women and children in the household. Additionally, poor patients with CVD are likely to be marginalized and their increasing numbers, as the CVD epidemic matures, will in all probability lead to huge inequalities in South Asian health care.

In the context of the development sector's "gender focus" it needs to be recognized that the CVD death toll is not limited to men. Data in the developed world setting shows that while CVD mortality rates are lower in women, 30-69 years of age than in men, they still exceed the mortality rates of every other cause of death.[123] In terms of total deaths CVD have claimed the lives of more females than males. Despite this grim picture, most women are far more afraid of breast cancer than of CVD even though CVD have been reported to cause almost 1 in 2 deaths in women while breast cancer causes 1 in 28 women deaths.[126] It has been demonstrated from the study of coronary risk in South Asian expatriate women that the sex difference in coronary mortality is narrower than in Europeans so that some of the immunity of women from CHD is lost in South Asian populations.[127] When extrapolated to the native setting this has serious implications in view of the limited opportunities that women have to access care in a gender-biased culture. This highlights the need to prioritize prevention and to consider women's health beyond the definition of reproductive health.

In the development sector, several policy and implementation frameworks are geared to strengthen health systems and improve the quality and coverage of maternal health care with reduction in maternal mortality as the outcome target. In this context it needs to be recognized that one third of maternal mortality is attributable to pregnancy-induced hypertension. Clearly a lifestyle modification approach integrated with reproductive health care will be invaluable to meet this target and will also open the doors to an effective community wide health promotion initiative.

The identification of the overall CVD impact on the under-privileged communities therefore makes the case to highlight CVD prevention as being directly synonymous with the pro-poor development policies with a view to engaging the development sector in this effort.

Opportunities for intervention at the programme level

Policies to promote CVD prevention in South Asia need to consider the existing health care delivery channels and identify opportunities within the system. By western standards most South Asian public health systems are ill equipped and under funded to implement comprehensive CVD control polices. However, there are several channels that are unique to the South Asian health systems. Over the decades extensive population welfare activities, communicable disease control programmes, vaccination campaigns and poverty reduction activities in the rural and urban underprivileged areas have created networks at the grassroots level with significant outreach. These existing and operational networks integrate public and private sector health services directly and indirectly with the community. These channels can be effectively used not only for CVD health promotion but also for population-wide screening programmes as in the case of blood pressure screening with favorable cost and logistic implications; this approach offers an alternative to independent vertical programmes for CVD control in the face of resource constraints. Such programmes in the public and the private sector are supported through the financial participation of international development agencies. Clearly a policy shift that favors the integration of the CVD prevention approach can be most useful in this regard.

Several other opportunities can be useful with regard to CVD health promotion in South Asia. The influence of locally influential personnel as in the case of feudal lords and tribe's chiefs can be seen as an effective means of inculcating behaviour change within their own populations. Fewer newspapers read by almost all social classes ensure a higher penetration, unlike developed countries where class and education segregation make the newspaper print far more diverse and not as efficient in terms of penetration. The presence of fewer electronic media channel options translates into a higher viewership of a single channel and therefore a higher penetration of messages. In this context, the public sector control on the media can be seen as a potentially effective opportunity.

The prevention research agenda

There are basic issues around cardiovascular research that make research agendas unbalanced and biased towards therapy and technology. Relating to risk factor research, it is important to realize that the epidemiology of diseases is based on studies carried out only on 20% of the world's population confined to the western world. This is particularly relevant in the context of the South Asian CVD risk and has already been alluded to in the section on epidemiology. CVD research in this region should build on existing prevalence surveys and should in addition, prioritize on implementation research that evaluates feasible interventions. Necessary infrastructure support and local capacity building for research is crucial to these approaches.

The role of health professionals

On the population level, health professionals can play a crucial role in influencing lifestyle decisions in poor countries. Their influence as local advocates places their role beyond their clinical capacities and extends to the population in general. It needs to be recognized that majority of the health care delivery in remote rural areas in the region is through formally and informally trained and traditional health professionals; it is imperative to include them in the module to maximize the impact at the grass roots level. Confining involvement to lifestyle and behavior change and population-wide screening measures may obviate ethical issues around such an approach.

There can be several approaches to engage health professionals in CHD prevention. One such approach focuses on drawing professionals into the prevention loop through opportunistic screening programmes. Blood pressure screening is perceived by the public as well as the providers as meeting a recognized 'clinical' need. Therefore, it elicits a stronger motivation and draws together a coalition of health professionals from diverse disciplines along with the public. The programme is unlikely to encounter the powerful resistance of organized vested interests as, for example, a tobacco control programme would. Since risk reduction at every level of elevated blood pressure envisages 'comprehensive cardiovascular disease risk reduction' as the goal, hypertension control would also be a vehicle for dietary control, tobacco control, diabetes control and obesity control. Thus, it would open the door for effective multi-pronged community intervention for CVD control.[128]

Health professionals should be the target for specific training with regard to CVD prevention both at the population and the clinical level. At the clinical level it needs to be recognized that physicians in South Asia usually do not have the support of related health professionals such as dietitians and the support services of specialized anti-smoking, weight reduction and diabetic clinics, as is the norm in the developed world. Professional training at all levels should therefore address this need with curricula introduced for physicians and health professionals during the course of formal and informal training. To maximize the impact of training, *train the trainers* approach may be adopted for promoting CVD prevention at the professional level.

Training must also focus on the provision of evidence-based, cost-effective and above all affordable care. Analysis of cost of therapeutic packages viewed against household incomes and out of pocket health expenditure reveals that several packages are unaffordable for the vast majority of the population (Appendix A). This would adversely affect the compliance of patients with their prescribed care. It is therefore relevant to grade recommendations based on cost and individual affordability. Such an approach may raise ethical issues but given than the circumstances it can be argued that not issuing such guidelines will also be unethical since the ideal option would be unaffordable for the vast majority; identifying such efforts in the cost-effectiveness dimension can also mitigate these concerns.

The current information and communication technology (ICT) boom can play a significant role in advancing the prevention agenda in South Asia to target the group of health professionals with access to this facility. Though of limited use in the larger context, it can play a significant role amongst the key players to create awareness of the magnitude of this issue, to disseminate data, and facilitate training.

Risk factor modification in South Asia

In any population, majority of the individuals have moderate levels of risk factors. Together those at moderate risk contribute more to the total burden of disease than those at the higher end. This highlights the need to address risk factor modification at the population level through the primary[viii] and the primordial[ix] prevention approaches rather than focus on the high-risk approach alone. The largest proportion of CVD events is also known to occur due to a combination of moderate elevations of many risk factors. The role of risk interaction should also emphasized for the South Asian population, in view of the higher prevalence of risk clustering in this ethnic group.

In South Asia where the challenges of addressing CVD are serious, primordial prevention should feature prominently as part of the CHD prevention strategy, preserving lifestyles in the rural areas and preventing the introduction of changes that have the potential to accelerate rates of CHD in the region. The other priority should involve the population-based primary prevention approach that aims to decrease the population levels of common CHD risk factors. Studies on other Asian populations have indicated that a 2% reduction of mean blood pressure has a potential to prevent 1.2 million deaths from stroke and 0.6 million from CHD every year;[129] clearly this approach is logical for the vast populations of the South Asian region.

Population goals should therefore focus on lifestyle interventions centered on cost effective approaches involving dietary modification, tobacco use cessation, physical activity, weight loss and stress management. The

[viii] Guidance given to individuals with known risk factors but without established CHD
[ix] Prevention of the acquisition or augmentation of risk factors or preserving risk factor free societies from the penetration of risk factor epidemics

population-wide approach should also encompass screening for high blood pressure where possible.

In the South Asian context guidelines and recommendations, both for the clinical and public health approaches need to be different from those that are developed in other settings because of cultural considerations and resource constraints. Several issues need to be recognized in this context. Clinical guidelines for the South Asia region need to be clear, simple, user-friendly socio-culturally customized with an explicit set of options for major decisions, supported by current and valid recent evidence, in a simple and accessible format and also need to be flexible to meet the needs of individual patients. Whereas concerns relating to flexibility in the developed world largely center on patients being able to determine their own course of treatment according to their own values, in South Asia they stem from economic issues. Thus the application of the same guidelines to technology-laden tertiary care units, and to remote rural health care units without a serving road or electricity, several hours away from the nearest coronary care unit is a challenge. Cost is a major factor for compliance in South Asia where health insurance is virtually nonexistent and most expenses are borne by patients out of pocket. This has necessitated the inclusion of a cost-based approach to the therapeutic recommendations in order to facilitate treatment choices according to the resources at hand.

Dietary recommendations for the South Asian population need to be culturally specific and need to cater to the feasibility of modifications in view of what is available, acceptable and affordable. The South Asian diet is significantly different from the western diet for which healthier modifications have been developed extensively. A heart healthier version of the South Asian diet has been developed and is appended to this document (Appendix B). Variation in the dietary patterns of populations in different parts of South Asia have been taken into consideration while drawing up these recommendations. This dietary guideline should be used as a baseline framework for individual regions within countries with diverse dietary patterns to expand on.

Cut off values for BMI need to be lower in this population; emerging data from the "INTERHEART Study" suggests that in South Asians, increases in BMI from 22 to a range of 23 to 25 is associated with a 30% increase in cardiovascular disease[130] and therefore lower BMI cut off points have been

recommended. Cut off values for waist circumference also need to be lowered in view of the average height of individuals in the South Asian subcontinent which is about 1.7 m for men and 1.58 m for women in urban settings and about 2.5 to 5 cm shorter in rural settings; based on this data cut off points for waist circumference have been lowered to 91.5 cm in men and 84 cm in women.

Recommendations on smoking cessation in South Asia need to take into consideration the different forms in which tobacco is used in the subcontinent in addition to cigarettes; it is therefore appropriate to refer to "tobacco use" rather than "smoking" both at the public health and clinical levels. This includes cigarette smoking, smoking of local forms of tobacco such as the hukka[x], beeri[xi] and chewable smokeless tobacco. Recommendations on tobacco use cessation should address this issue.

Physical activity and weight reduction offer the greatest opportunity for intervention in these cultures and indeed in any culture. Physical activity should however be encouraged for women in Muslim cultures in an environment and form that respects religious proscriptions. Recommendations with regard to CHD in women have been addressed under a separate heading to emphasize this unrecognized issue; this also includes certain aspects of risk factor management that are unique to women.

Increased serum cholesterol should be recognized as an important risk factor for CHD but should be taken in the context of other risk factors such as smoking, raised blood pressure and physical inactivity. It should also be recognized that blood cholesterol alone is a relatively poor predictor of individual CHD risk. The majority of CHD events occur in people with average or low blood cholesterol levels. Consequently, cholesterol screening at a population level is not recommended.[131] The need to highlight this in the South Asian context is an important element of the prevention-based approach to CHD.

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[x] Device for smoking tobacco which is like the middle eastern "hubble bubble"; tobacco is heated in a pot and is made to pass through water cisterns before being inhaled though a along tube; used for communal smoking.

[xi] Beeri is a local form of cigarette in which tobacco is rolled in a leaf.

As part of the high-risk population approach, individuals should be identified on the basis of easily identifiable markers for targeted screening for hypercholestrolaemia and diabetes. These markers may include obesity, family history, the presence of other risk factors and CVD. Recent studies have also identified that the simultaneous measurements and interpretation of simple variables, such as waist circumference, could be used as inexpensive screening tools for the identification of men at risk for CVD;[75] this may be particularly relevant for South Asians. The most effective way to reach such groups is to complement the population-wide health promotion strategies with carefully targeted messages interlinking them with locally available health services.

FRAMEWORK RECOMMENDATIONS

Framework policy recommendations

- At the macro policy level the need to identify CVD prevention as part of the primary health care package should be recognized and given due priority alongside reproductive and nutritional health and communicable diseases.
- CVD prevention should be seen as being synergistic with poverty reduction strategies, and addressed in development initiatives.
- Policy changes should integrate heart health with communicable disease, reproductive health and population control programmes in an attempt to create cost and time effective opportunities for prevention.
- Policy change with respect to CVD must include relevant areas in the domains of food and nutrition, tobacco, agro-industrial diversification, urban planning, education and rural development.
- Policies relating to food and nutrition should ensure availability, favorable pricing, and labeling of heart healthy food.
- Policy issues regarding tobacco should be dealt with in two stages. Initial priorities should focus on goals that are realistically achievable in the short to medium term, such as imposing constraints on advertising and sale to minors, displaying statutory warnings on labels and legislation to ban smoking in public places and transport utilities. Subsequently major issues should be addressed such as agro-industrial diversification favoring tobacco substitution, and transnational marketing of tobacco, which may affect pricing, production and taxation.
- Policy changes should address transport, urban planning and neighborhood development to promote physical fitness and provide tax incentives for exercise equipment. Policy changes to promote worksite physical activity should consider flexible working hours and worksite exercise facilities.

- Policies should ensure the availability of effective drugs, devices and procedures at affordable prices to be used in a cost-effective manner.

Framework programme recommendations

- **Public health**
  - Culturally and linguistically appropriate and effective community health promotion and disease prevention programmes should be encouraged and made available; if they already exist they should be strengthened and integrated with the formal health care sector.
  - Cardiovascular disease prevention should be integrated with primary heath care.
  - Cardiovascular health education should be integrated with other health promotion initiatives.
  - The public health approach should target population-wide lifestyle interventions, population-wide screening for high blood pressure and screening of the high-risk group for diabetes and hypercholestrolaemia.
  - Lifestyle advice should center on tobacco use cessation, weight control, a heart healthy diet, physical activity and stress management.
  - Cardiovascular health promotion should be part of the national media strategy.
  - Cardiovascular health should be addressed in school based health education and/or as part of the science curriculum.
  - Cardiovascular health education should be offered in places of religious worship and worksites where appropriate.
  - Infrastructure support and local capacity building for research should be prioritized.

- **Clinical**
  - Cost-effective and customized diagnostic and management algorithms should be developed for the treatment of all common cardiovascular diseases. These guidelines should be made widely available in the region.
  - The availability of effective and affordable drugs, devices and procedures should be ensured.

- Referral chains should be established which should provide effective links between primary, secondary and tertiary health care centers whenever required.
- "Train the trainers" approach should be adopted for promoting CVD prevention at the professional level.
- All physicians must commit the time to make a proper assessment and initiate preventive efforts. Physician's advocacy of healthy habits including tobacco-use cessation, healthy eating, weight control, and physical activity should be universal.
- Physicians in South Asia usually lack support of related health professionals such as dietitians and the support services of specialized anti-smoking, weight reduction and diabetic clinics, as is the norm in the developed world. Therefore a customized risk management curriculum should be introduced for physicians and health professionals during the course of formal and informal training.
- Specialist opinion should be sought whenever essential and feasible. The cut-off points for specialist referral for every risk category should be recognized.

PRIMORDIAL PREVENTION

The major thrust in the prevention of atherosclerotic and hypertensive heart diseases over the last two decades has been the detection and control of their risk factors, whereas the prevention of risk factors themselves has not received much attention.[132] "Prevention of the acquisition or augmentation of risk factors" is distinct from risk factor "detection" and "management" (constituting primary prevention) and is the concept of "primordial prevention" coined by Strasser[133] in 1980 meaning "preserving risk factor free societies from the penetration of risk factor epidemics". In South Asia where the challenges of addressing CVD are serious, primordial prevention should feature prominently as part of the CHD prevention strategy, preserving lifestyles in the rural areas and preventing the introduction of changes that have the potential to accelerate epidemic rates of CHD in the region.

Such interventions are effective both in early life and later; as the risk factor incidence continues well into the later years; interventions should therefore, ideally cover the entire lifespan of populations. School health programmes, which are crucial in targeting behavioural change in childhood, should therefore be complementary to the adolescent education programmes and the media advice targeting adults. Rural communities in the SAARC region, constituting more than 60% of the population, are likely to be the prime beneficiaries of the primordial prevention approach as they have not, as yet been exposed to the influences and risks that are part of urbanization and acculturation.

Goal:

- Preserving entire risk factor-free societies from the penetration of risk factor epidemics

Recommendations:

- Primordial prevention should be recognized as a priority at the policy and programme level, with the necessary investment of resources.
- Refer to the programme framework recommendations.

PRIMARY PREVENTION

Primary prevention refers to guidance given to individuals with known risk factors but without established CHD. Primary prevention involves population level prevention and encompasses both population goals and treatment of risk factors in individuals without established CHD through the public health and the clinical approaches. Whereas the public health approach targets both the general population and the high-risk group, the clinical approach gives physicians the opportunity to detect the presence of established risk factors and to reinforce lifestyle changes and prescribe drug therapy if required to modify these risk factors in an attempt to avert the intensification of these risk factors and consequent CHD. The emphasis in this section will be on modifiable risk factors.

TOBACCO USE

Public health approach

- The use of tobacco rather than "smoking" should be taken into account. This includes cigarette smoking, smoking of local forms of tobacco ('hukka', 'beedies' and chillums) and chewable smokeless tobacco. These should be referred to as cigarette and other forms of tobacco (COT) use.
- Counseling for COT cessation should be universal for all health encounters.
- Misconceptions relating to local forms of tobacco use, as being relatively harmless should be addressed.
- Passive smoking should be addressed alongside COT use wherever appropriate; passive smoking should also be addressed as part of the health promotion component of reproductive health initiatives with reference to its implications for the health of the newborn.

- Physicians and all other health professionals, institutions and professional organizations should collaborate actively to support smoking cessation programmes.
- Customized self-help materials assisting with smoking cessation should be developed.
- Refer to framework recommendations.

Clinical approach

Goal: cigarette and other forms of tobacco-use cessation.
Screening: all patients and their families.
Recommendations:

- The present and past status of COT use, and exposure to passive smoking should be determined and quantified.
- Counseling for COT use cessation should be universal and reinforcement of the non-smoking status of patients and their families should preferably be a part of every evaluation.
- Referral to published material and smoking cessation programmes where applicable and accessible should be encouraged and facilitated.
- Physicians in general and cardiovascular physicians in particular should be familiarized with Nicotine Replacement Therapy (NRT). Where cost, comprehension and availability is not an issue; NRT should be offered to patients and monitored.

PHYSICAL ACTIVITY

Goal: accumulation of equal to or more than 30 minutes of moderate intensity physical activity on most, preferably all days of the week.
Screening: all individuals.
Recommendations:

- A minimum of 30 minutes of moderate intensity dynamic exercise should be recommended to all individuals; this may be performed in intermittent shorter bouts (e.g. 10 minutes). Examples of such recommended activity are, brisk walking, jogging, bicycling or walking instead of using the car, etc.
- Recommendations on physical activity should take into account cultural norms and sustainability.

- Physical activity should be encouraged for women in Muslim cultures in an environment and form that respects religious proscriptions. Support from Islamic religious leaders is crucial in endorsing the need for more exercise and in encouraging full participation of women in Muslim cultures.

WEIGHT

Goal:

- BMI lower than 23.
- Waist circumference less than 91.5 cm in men and 84 cm in women.

Screening:

Where facilities exist and there are no time constraints, ideally, measurement of the patients' weight, height, waist and hip, and calculation of BMI and waist hip ratio should be carried out at least once. When time constraints prohibit this, measurement of the waist should be carried out and the patient weighed at least once.

Recommendations:

- Waist circumference should be used as an inexpensive screening tool for the identification of men at high risk of CHD.
- It should be recognized that overweight and obesity are associated with insulin resistance and the metabolic syndrome,[xii] the risk factors of the metabolic syndrome are highly concordant and that the prevalence of the metabolic syndrome is high among South Asians.
- Weight management should begin with a low calorie diet (Appendix B) and physical activity.

DIET

- All individuals should be encouraged to adhere to the Heart Healthy Eating Plan for South Asians (Appendix B).
- Patients who drink alcoholic beverages should be advised to restrict their intake to two drinks per day. Patients who do not drink should have this choice reinforced.

[xii] According to the ATP 111 guidelines, the diagnosis of the syndrome is made when three or more of the following risk determinants are present: waist circumference more than 102 cm in males and 88 cm in females, TG >150 mg/dl, HDL cholesterol <40 in men and <50 in women, blood pressure >130/85 mm hg and fasting blood glucose >110 mg/dl. The cut off values for waist circumference have been lowered for the South Asian population based on the unpublished results of the INTERHEART data for the South Asian ethnic group.

- All individuals should be advised to restrict their daily salt to less than 6 grams per day (moderate use of salt in the curry, no added salt to the staple bread, no added salt at the table and no commercial pickles and chutneys).

STRESS

- Depression, elevated levels of depressive symptoms, anxiety, low social support, hopelessness, anger, hostility and stress at work should all be recognized as risk states for CHD.
- It should be recognized that these attributes can also negatively influence behaviourally alterable risk factors such as smoking, exercise and diet as well as patients' tendencies to comply with recommended medications or to respond to symptoms by seeking medical treatment.
- Counseling for stress in the context of CHD prevention should be routinely practiced and stress-relieving techniques that are religiously and culturally acceptable, advocated.
- For severe symptoms, referrals to a psychiatrist, or in case where one is inaccessible, appropriate medication should be advised.

HIGH BLOOD PRESSURE

Public health approach

- It should be advocated that the beneficial effects of lowering blood pressure extend beyond preventing coronary heart disease to also preventing stroke.
- High blood pressure screening and control should be considered as the ideal "entry programme" of an integrated CVD control strategy in the SAARC countries. All individuals should have their blood pressure checked once a year after the age of 30. Those with normal blood pressure should be encouraged to have their blood pressure checked every year.
- Population-wide screening should be the goal of Hypertension Detection Programmes in view of the high prevalence of high blood pressure in the South Asia. Where not feasible due to scarcity of resources, screening of the high-risk population should be considered a matter of priority, with formal screening programmes including and screening

advice targeted to men and women aged 45 years and above, those with generalized and central obesity, a strong family history of hypertension, stroke and sudden premature death in the immediate family or a combination of these factors.

- Opportunistic screening involving all categories of health care providers using any health care encounter to screen patients or individuals living in a community for hypertension should be prioritized.

Clinical approach[xiii]

Goal:

- Less than 140 mm Hg systolic and 90 mm Hg diastolic.
- Less than or equal to 130 mm Hg systolic and 85 mm Hg diastolic in renal insufficiency or diabetes.

Screening:

- Initial evaluation of patients with high blood pressure should be inclusive of a thorough history and physical examination, with only a limited number of routine investigations.
- Once confirmed, the aim of evaluation for high blood pressure should be to elicit and document the 8 "C"s. 1) the *causes* of secondary hypertension where curative therapy may be targeted; 2) *contributory* factors where aggressive modification may be beneficial in terms of medication-free or low cost control; 3) the *complications* of hypertension; 4) the presence of additional *cardiovascular risk factors*, crucial for risk categorization; 5) *contraindications* to specific drugs; 6) *co-morbid* conditions which influence choice of medication; 7) *cost considerations* which may affect long-term compliance and 8) patient *categorization* for drug therapy.
- Routine investigations
  - Where cost is not an issue: urine test for protein and blood, serum creatinine and electrolytes, blood glucose and serum total cholesterol, triglycerides, LDL and HDL cholesterol and ECG.
  - Where cost constrained, urine for protein initially, and blood glucose, cholesterol and ECG only if clinically warranted.

[xiii] The cut-off values for therapy have been based on the Sixth Report of the Joint National Committee on the Prevention, Detection, Evaluation and Treatment of High Blood Pressure.

Recommendations:

- Lifestyle advice given to *all* hypertensive patients should be clear on two issues: *lifestyle interventions can reduce the need for drug therapy and enhance the effect of antihypertensive agents.* Therefore encourage weight reduction, reduction in salt intake to ≤6 g/day (do not add salt to food at the table and avoid pickles), reduction in fat intake, limitation of alcohol consumption ≤21 units/week in men and ≤14 units/week in women, regular dynamic exercise and increase in fruit and vegetable consumption to 7 portions per day. And that *lifestyle interventions can reduce the overall cardiovascular risk.* Therefore encourage patients to quit smoking, reduce their saturated fat intake and substitute it with polyunsaturated, monounsaturated fats and oily fish and be physically active.
- Patients with high normal blood pressure 130-139/85-89 mm Hg.
  - No or one risk factor (not including diabetes): lifestyle modification.
  - Multiple risk factors (high-risk population) and diabetics: drug therapy along with lifestyle modification.
- Patients with stage 1 hypertension: 140-149/90-99 mm Hg.
  - No risk factors: lifestyle modification up to 12 months.
  - 1 risk factor (not including diabetes): lifestyle modification up to 6 months.
  - Multiple risk factors and diabetics: drug therapy along with lifestyle modification.
- Patients with stage 2 hypertension: ≥160 systolic and or ≥100 diastolic, should be given drug therapy under all circumstances along with lifestyle modification.
- Prescribing anti-hypertensive therapy

  Appendix A tabulates the monthly cost of various anti-hypertensive drugs; for each drug within a class the minimum effective and the ceiling recommended dosage has been listed. For both, the monthly minimum and maximum cost packages available in the market have been calculated; these costs have been viewed as a percentage of the monthly rural and urban household incomes and as a percentage of the monthly household heath expenditure by the private and the public sector. The cost of anti-hypertensive medication differs in the various SAARC countries, overall the cost variability being highest in Pakistan. The appended cost calculation is intended to give the prescribing physician an overview of the health economic impact of long-term anti-

hypertensive therapy with implications for compliance and disease morbidity. Cost of therapy should be visualized as a major consideration in the management of high blood pressure and therefore, the following recognized:

- Option 1, Ideal: Where cost is not a consideration, or where patients are sure to be reimbursed for their medical expenses, the protocol given in Table 2 is recommended. In this situation the choice of antihypertensive medication is an individualized decision. In uncomplicated hypertension, pharmacological therapy should begin with beta-blockers or diuretics. It should however be recognized that there are compelling indications for specific agents in certain clinical situations.

Table 3 *compelling indications and contraindications for various anti-hypertensive drugs.*

Drugs	Compelling Indications	Compelling Contraindications
Diuretics	First line therapy unless other compelling indications	Gout
Beta blockers	Myocardial infarction Angina	Asthma Heart block
ACE Inhibitors	Heart failure LV dysfunction Post myocardial infarction	Pregnancy Bilateral renal artery stenosis
Calcium Antagonists (Dihydropyridine)	Elderly Isolated systolic hypertension	
Calcium antagonists (Rate limiting)	Angina	Heart block Heart failure
Alpha Blockers	Prostatism	Urinary incontinence
Angiotensin II Antagonists	As for ACE inhibitors; use if ACE inhibitors are contraindicated.	As for ACE inhibitors; use if ACE inhibitors are contraindicated.

- Option 2, low cost: where cost constraints make long-term compliance unlikely or where patients benefit from charitable relief over an extended period of time, beta blockers and diuretics should be prescribed unless there are pressing contraindications, or where the presence of other co-morbid condition(s) makes the choice of another drug a matter of priority. Beta blockers and diuretics have

been shown to be the most cost-effective drugs.[134] In indirect comparisons between beta blockers, diuretics and newer ACE inhibitors and calcium channel blockers there was no evidence that the newer drugs were associated with fewer side effects.[135] The other approach to ensure long-term affordability involves calculation of the total monthly prescription cost of medication taken by an individual; this should be less than 5% of the monthly per person household income. It is also recommended that all physicians should familiarize themselves with ranking of drugs according to their cost within classes, so that one automatically becomes the preferred option in the group being the cheapest.

DYSLIPIDAEMIA

Public health approach

Increased serum cholesterol should be recognized as an important risk factor for CHD but should be taken in the context of other risk factors such as smoking, raised blood pressure and physical inactivity. It should also be recognized that blood cholesterol alone is a relatively poor predictor of individual CHD risk. The majority of CHD events occur in people with average or low blood cholesterol levels. Consequently, cholesterol screening at a population level is not recommended.[131]

- Targeted screening or screening of the high-risk population should be the goal. This involves checking for high cholesterol levels in patients identified on the basis of clinical markers such as the presence of hypertension, obesity, or a family history of coronary or cerebrovascular disease.
- In those identified for screening, a complete lipoprotein profile (total cholesterol, LDL cholesterol, HDL cholesterol, and triglycerides) is the preferred initial test.
- The Heart Healthy Eating Plan for South Asians should be promoted for all adults (Appendix B).

Clinical approach[xiv]

Goals:

- Total cholesterol less than 200 mg/dl

- LDL cholesterol (LDL)
  - less than or equal to 160 mg/dl, if 0-1 risk factors
  - less than 130 mg/dl, if 2 or more risk factors
  - less than 100 mg/dl if diabetic
- High triglycerides
  - Triglycerides less than 150 mg/dl
  - Prioritize goals for LDL lowering
  - Management of the metabolic syndrome

Screening:

- Patients in whom there is a possibility of secondary causes as in patients with renal disease, hypothyroidism and liver failure should be screened at least once during the course of these illnesses.
- Patients with xanthomata or a family history of early CHD with a genetic dyslipidaemia should have screening once at detection of disease and once again when over the age of 30, and if normal 5 yearly thereafter.
- Patients with other risk factors for cardiovascular disease, at least once.

Recommendations:[xv]

- Dietary advice for cholesterol lowering should be routinely given as part of the first evaluation and reinforced during subsequent visits.
- The use of *Isphagula*, which is effective in cholesterol lowering by 10-15% and is traditionally used in the subcontinent, should be recommended.
- Dietary therapy: LDL based cut off points for reinforcing the Heart Healthy Eating Plan for South Asians should be recognized; it should additionally be noted that these are *not* cut off points for the institution of drug therapy.
  - LDL greater than 160 mg/dl, if 0-1 risk factors
  - LDL greater than 130 mg/dl, if 2 or more risk factors
  - LDL greater than 100 mg/dl if diabetic
- Patients in whom dietary therapy fails should be considered for drug therapy if long-term affordability is not an issue and they are at a particularly high risk of CHD events based on their total risk profile.
- Drug therapy: The decision to use drug therapy to control risk factors depends on a balanced assessment of absolute risk and the efficacy, safety, cost-effectiveness, and long-term affordability of the intervention.

[xiv] Therapeutic goals have been based on the Adult Treatment Panel III Guidelines

[xv] Risk factors not including diabetes, for diabetes in the primary prevention setting, refer to the section on diabetes

The monthly cost of various lipid-lowering medications, when taken as a percentage of the monthly household incomes in the urban and the rural areas and the health expenditure by the private and the public sector is appended (Appendix A). It is evident that lipid-lowering therapy would be unaffordable for the vast majority of the population in the region. Use of cholesterol-lowering drugs for the prevention of CHD should depend heavily on the assessment of absolute risk; drug therapy should be used cautiously for primary prevention in young adults who are otherwise at low risk. It should be recognized that in asymptomatic people who are at high risk of CHD, the costs of lowering cholesterol, using statins are high relative to the benefits. It should be recognized that cholesterol lowering is one of a number of methods of reducing the risks of CVD. The other equally important methods are smoking cessation, physical activity, control of hypertension and weight reduction in the overweight. It should also be recognized that the cost effectiveness of some anti-hypertensives, aspirin and beta blockers is greater than statins. Greater priority should therefore be given to the appropriate use of other drug treatments. Before considering the use of lipid lowering drugs, other methods to reduce the risk of coronary heart disease (CHD) should be actively instigated; these include advice and help on COT use cessation, dietary advice to control weight and lower lipids and advice on regular physical activity.

- Where cost is not a consideration therapy should be based on specific LDL, HDL and TG cut of points.

LDL:

- LDL cut off points for the institution of pharmacological therapy should be recognized; these are:
  - LDL greater than 190 mg/dl, if 0-1 risk factors
    LDL greater than 160 mg/dl if 2 or more risk factors
  - LDL greater than 130 mg/dl if the risk is very high
  - Therapy with LDL lowering should be targeted to people who are at high risk of CHD rather than based upon cholesterol levels alone.
- Triglycerides:
  - The importance of high triglyceride levels and low HDL levels should be emphasized for the South Asian population.
  - Borderline high triglyceride levels, 150-199: weight reduction and physical activity.

- High triglyceride levels, 200-499: weight reduction, physical activity and drug therapy to lower LDL to the desired limits with LDL lowering drug, or by adding fibrates.
- Very high triglycerides: very low fat diet (less than or equal to 15% of the caloric intake, weight reduction, increased physical activity and triglyceride lowering drug (fibrate or nicotinic acid). Only after triglyceride levels have been lowered to less than 500 mg/dl should attention turn to LDL lowering.

- HDL:
  - For low HDL ≤40 mg/dl, follow guidelines for LDL lowering, emphasize on weight reduction and increase in physical activity particularly when in association with the metabolic syndrome.

DIABETES

Public health approach

- Population-wide screening for diabetes in all adults over the age of 35 years in combination with the assessment of their positive and negative risk factors is theoretically ideal; however, realistically:
- Targeted screening or screening of the high risk population should be the goal which involves checking for blood glucose levels in patients identified on the basis of clinical markers such as the presence of hypertension, generalized and central obesity.

Clinical approach

Goal:

- Fasting blood glucose level of less than 120 mg/dl
- Therapeutic goal of blood pressure lowering is 130/85 mm Hg
- Therapeutic goal of LDL lowering is <100 mg/dl

Screening:

- Fasting blood glucose should be measured in all individuals with more than two risk factors for CHD.

Recommendations:

- All diabetic COT users should be made aware of the fact that they are up to four times more likely to suffer from cardiovascular death than non-smokers, and hence strongly discouraged from smoking.
- Patients should be encouraged to actively participate in their treatment.

- ACE inhibitor therapy and diuretics should be prioritized as anti-hypertensive agents.
- All patients should have their lipid levels checked and should be managed according to the recommendations given in the relevant section.
- Initiate LDL lowering drugs when LDL cholesterol >130 mg/dl. When LDL is 100-129 mg/dl, exercise clinical judgment to initiate therapy. Manage triglycerides as discussed in the section on triglycerides under dyslipidaemia.

DRUG THERAPY

- Low dose Aspirin (75 mg) should be given to treated hypertensive patients whose blood pressure is well controlled and in men with particularly high CHD risk. Aspirin or other platelet modifying agents should not be routinely indicated in the management of high-risk individuals.
- Empirical vitamin supplementation with folic acid and vitamins of the B complex series should not be recommended at the cost of other essential medication.
- Drug therapy for high blood pressure and dyslipidaemia should be advised as indicated in the relevant sections.

NOVEL RISK FACTORS

- Screening and management of novel risk factors such as homocysteine, coagulation factors, platelet reactivates, Lp(a) and markers of infection should not be pursued.

WOMEN

- Risk management strategies for women should be as aggressive as in men.
- Although general recommendations apply to both men and women, certain aspects of risk factor management that are unique to women should be actively addressed. During pregnancy, complete COT use cessation, avoidance of excess weight gain, and avoidance of food rich in fat should be promoted.

- Women with diabetes should have tighter control of diabetes, as diabetes is a more powerful risk factor in women (3-7 fold compared to 2-3 fold in men).
- The rising trend of smoking amongst women in the region should be strongly discouraged.
- With the increasing emphasis on population control in the region, it should be recognized that the use of low dose oral contraceptive birth control preparations should largely be confined to women less than 35 years of age, who do not smoke and who do not have hypertension.
- Women who are unable to remain physically active outside of their own homes due to cultural constraints should be encouraged to remain active at home while reinforcing the importance of physical activity.
- Hormone Replacement Therapy (HRT) should not be primarily used for reduction in CHD risk.

SECONDARY PREVENTION

Secondary prevention is the modification of risk factors in patients with CHD to prevent the further recurrence of such events. These guidelines apply to all those who have any form of CHD such as a prior myocardial infarction, stable and unstable angina and those having undergone coronary artery procedures such as coronary artery bypass grafting and angioplasty or stenting procedures.

TOBACCO USE

Goal: complete COT use cessation
Screening: all patients with CHD
Recommendations:

- COT use cessation should be a priority in CHD patients. Advice should clearly state that survivors of MI who smoke, have twice the rate of recurrent infarction and cardiac death compared to those who do not smoke and that in other patients with CHD who smoke, and have not, as yet, suffered from an acute event, the chances of an acute coronary event are much higher as compared to those who do not smoke.
- In addition, all recommendations given under the framework of the clinical strategy as part of the Primary Prevention plan regarding tobacco-use apply here, with an emphasis that the attempt at tobacco-use cessation should be more aggressive as part of the Secondary Prevention approach.

PHYSICAL ACTIVITY

- Refer to the advice given as part of the Primary Prevention plan.

WEIGHT MANAGEMENT

- Refer to the advice given as part of the Primary Prevention plan.

DIET

- The Heart Healthy Eating Plan for South Asians should be recommended for all patients.

HIGH BLOOD PRESSURE

Goal: blood pressure of 130 mm hg systolic and 80 mm Hg diastolic.
Screening: all patients with CHD (the screening strategy outlined as part of the Primary Prevention plan regarding the clinical approach to high blood pressure applies here).
Recommendations:

- Lifestyle advice given as part of the Primary Prevention plan regarding the clinical approach to high blood pressure applies here.
- Drug therapy should be instituted in all cases of CHD with blood pressure levels over 130 systolic and 80 diastolic. Refer to the section on prescription of antihypertensive drugs discussed as part of the Primary Prevention plan.
- Betablockers need to be prioritized for the management of high blood pressure in patients that have either suffered from a myocardial infarction or suffer from angina. In the presence of any contraindication, rate-limiting dihydropyridines are the second choice. (Refer to the section on hypertension in Primary Prevention for suggested recommendations regarding the compelling indications and contraindications of other drugs).

DYSLIPIDAEMIA

Goal:

- Primary goal: LDL less than or equal to 100 mg/dl
- Secondary goals: refer to goals as discussed under primary prevention

Screening: All patients with CHD

Recommendations:

- All patients should be strongly advised to adhere to the Heart Healthy Eating Plan for South Asians.
    - The first priority for lipid lowering drug therapy in patients with CHD should be patients who have had a myocardial infarction.[136] These patients have a very high CHD risk, and drug treatment is indicated when LDL is above 130 mg/dl. If LDL is between 100-130 mg/dl, clinical judgment needs to be exercised and drug therapy instituted only in high-risk cases where long-term affordability is not an issue. The second priority for lipid lowering therapy is in patients with angina or other clinically overt atherosclerotic disease; the same cut off points for therapy as mentioned previously for myocardial infarction apply.
    - It should however be recognized that lifestyle modifications inclusive of a lipid lowering diet, aspirin and beta blockade should be prioritized if long-term compliance to lipid lowering therapy is unlikely because of cost considerations.

DIABETES

- Refer to the advice given as part of the Primary Prevention plan.
- Additionally; it should be recognized that diabetes is a strong risk factor for CVD; this risk is independent of the risk associated with other risk factors. It should also be recognized that diabetes confers a worse prognosis after a cardiovascular event.

DRUG THERAPY

- In the absence of any contraindications, long-term beta blocker and ACE Inhibitor therapy should be given indefinitely to patients with myocardial infarction.
- Aspirin should be prescribed to all individuals with CHD. In the presence of aspirin allergy, anticoagulation should be instituted only in patients with a prior myocardial infarction.
- Refer to "High Blood Pressure" in this section
- Refer to "Dyslipidemia" in this section
- Refer to "HRT" in this section

SCREENING FOR NOVEL RISK FACTORS

- Screening and management of novel risk factors such as homocysteine, coagulation factors, platelet reactivates, Lp(a) and markers of infection should not be pursued.

WOMEN

- Refer to the advice given as part of the Primary Prevention plan.
- It should be recognized that there are significant differences in the modes of presentation of CHD amongst men and women. These differences have important implications in the South Asian context as women have problems accessing care. It should therefore be recognized that women are more likely to have vague symptoms, and symptoms are less likely to be brought on by exercise. They are also less likely to have unrecognized infarctions and non-Q wave infarctions. Women with CHD are also more likely to be hypertensive, obese and diabetic.

HORMONE REPLACEMENT THERAPY

- HRT with estrogen plus progestin should not be started in post-menopausal women with established CHD. However, post-menopausal women who are already taking estrogen and progestin for over three years may continue this therapy.

SCREENING OF RELATIVES

- Close relatives of patients should be screened for high blood pressure, diabetes and dyslipidaemia and should receive lifestyle advice.

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APPENDICES

APPENDIX A

Appendix A tabulates the monthly cost (US $) of available anti-hypertensive and lipid lowering drugs individually in each SAARC country. For each drug within a class the minimum effective and the ceiling recommended dosage has been listed. For both, the minimum and the maximum monthly cost packages have been calculated. These cost packages are based on the available minimum and maximal dosages of each drug in the market, in the absence of which cost for the minimum and the maximum recommended doses have been calculated from the cost of available dosage in the market. These costs have been viewed as a percentage of the monthly rural and urban household incomes and as a percentage of the monthly household heath expenditure by the private and the public sector. Local currencies have been converted into US $ based on the exchange rates as of July 18, 2001 displayed on http://theFinancial.com

PAKISTAN		Monthly cost of therapy		Cost of therapy as a percentage of the average rural household income		Cost of therapy as a percentage of the average urban household income		Cost of therapy as a percentage of the monthly household health expenditure by the public sector		Cost of therapy as a percentage of the monthly household health expenditure by the private sector	
Drug by Class	Dose	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available
Ace Inhibitors											
Captopril	25 mg	1.173	3.650	1.43	4.46	1.06	3.31	51.89	161.49	15.06	46.85
	100 mg	4.691	14.599	5.74	17.86	4.26	13.26	207.57	645.97	60.22	187.41
Enalapril	5 mg	1.013	2.102	1.24	2.57	0.92	1.91	44.84	92.99	13.01	26.98
	20 mg	4.053	8.407	4.96	10.28	3.68	7.63	179.34	371.97	52.03	107.91
Lisinopril	5 mg	2.041	2.491	2.50	3.05	1.85	2.26	90.29	110.22	26.20	31.98
	20 mg	8.163	9.964	9.98	12.19	7.41	9.05	361.18	440.89	104.78	127.91
Ramipril	1.25 mg		3.467		4.24		3.15		153.40		44.50
	5 mg		13.867		16.96		12.59		613.59		178.01
A2 Receptor Blockers											
Losartan	50 mg		23.306		28.51		21.16		1031.23		299.17
	100 mg		46.611		57.02		42.32		2062.45		598.35
Valsartan	80 mg		17.507		21.42		15.90		774.66		224.74
	160 mg		35.015		42.83		31.79		1549.33		449.48

Continued.....

Drug by Class	Dose	Monthly cost of therapy		Cost of therapy as a percentage of the average rural household income		Cost of therapy as a percentage of the average urban household income		Cost of therapy as a percentage of the monthly household health expenditure by the public sector		Cost of therapy as a percentage of the monthly household health expenditure by the private sector	
		Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available
Beta Blockers											
Propranolol	40 mg	0.572	1.084	0.70	1.33	0.52	0.98	25.32	47.95	7.35	13.91
	160 mg	2.289	4.335	2.80	5.30	2.08	3.94	101.30	191.80	29.39	55.64
Metoprolol	100 mg	2.346	2.843	2.87	3.48	2.13	2.58	103.79	125.79	30.11	36.49
	200 mg	4.691	5.686	5.74	6.95	4.26	5.16	207.57	251.58	60.22	72.99
Atenolol	50 mg	0.727	2.866	0.89	3.51	0.66	2.60	32.17	126.83	9.33	36.79
	100 mg	1.454	5.733	1.78	7.01	1.32	5.21	64.35	253.66	18.67	73.59
Ca Channel Blockers											
Nifedipine	20 mg	0.938	3.706	1.15	4.53	0.85	3.37	41.51	163.98	12.04	47.57
	80 mg	3.753	14.824	4.59	18.13	3.41	13.46	166.06	655.93	48.18	190.30
Amlodipine	5 mg	0.422	5.582	0.52	6.83	0.38	5.07	18.68	247.01	5.42	71.66
	10 mg	0.844	11.165	1.03	13.66	0.77	10.14	37.36	494.03	10.84	143.32
Felodipine	5 mg		4.752		5.81		4.32		210.27		61.00
	20 mg		19.009		23.25		17.26		841.09		244.01
Diltiazem	60 mg	1.876	4.841	2.30	5.92	1.70	4.40	83.03	214.22	24.09	62.15
	360 mg	11.259	29.048	13.77	35.53	10.22	26.38	498.18	1285.30	144.53	372.88
Verapamil	240 mg	2.050	3.181	2.51	3.89	1.86	2.89	90.71	140.73	26.32	40.83
	480 mg	4.100	6.361	5.02	7.78	3.72	5.78	181.42	281.47	52.63	81.66
Diuretics											
Indapamide	2.5 mg	1.642	2.857	2.01	3.49	1.49	2.59	72.65	126.41	21.08	36.67
Furosemide	20 mg	0.106	0.387	0.13	0.47	0.10	0.35	4.67	17.12	1.35	4.97
	40 mg	0.211	0.774	0.26	0.95	0.19	0.70	9.34	34.25	2.71	9.94

Continued.....

Drug by Class	Dose	Monthly cost of therapy		Cost of therapy as a percentage of the average rural household income		Cost of therapy as a percentage of the average urban household income		Cost of therapy as a percentage of the monthly household health expenditure by the public sector		Cost of therapy as a percentage of the monthly household health expenditure by the private sector	
		Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available
Spironolactone	100 mg		3.237		3.96		2.94		143.23		41.55
	200 mg		6.474		7.92		5.88		286.45		83.10
Methyldopa	250 mg		0.783		0.96		0.71		34.66		10.06
	3 g		9.401		11.50		8.54		415.98		120.68
Statins											
Lovastatin	20 mg	5.629	15.481	6.89	18.94	5.11	14.06	249.09	684.99	72.26	198.73
	80 mg	22.518	61.923	27.54	75.75	20.45	56.23	996.35	2739.97	289.06	794.91
Fluvastatin	20 mg		8.913		10.90		8.09		394.39		114.42
	80 mg		35.653		43.61		32.37		1577.56		457.67
Simvastatin	10 mg	6.450	15.129	7.89	18.51	5.86	13.74	285.41	669.43	82.80	194.21
	40 mg	25.801	60.516	31.56	74.03	23.43	54.95	1141.66	2677.70	331.21	776.84
Atorvastatin	10 mg		26.271		32.14		23.85		1162.41		337.23
	40 mg		105.082		128.54		95.42		4649.65		1348.94
Cerivastatin	0.4 mg		30.023		36.73		27.26		1328.47		385.41
	0.8 mg		60.047		73.45		54.52		2656.94		770.82
Fibric acid derivatives											
Gemfibrozil	900 mg	3.870	4.785		5.85	3.51	4.34	171.25	211.73	49.68	61.42
	1.5 g	6.450	7.975		9.76	5.86	7.24	285.41	352.88	82.80	102.37
Bezafibrate	200 mg	1.027	0.035	1.26	0.04	0.93	0.03	45.46	1.56	13.19	0.45
	600 mg	3.082	0.106	3.77	0.13	2.80	0.10	136.38	4.69	39.56	1.36

Continued.....

INDIA		Monthly cost of therapy		Cost of therapy as a percentage of the average rural household income		Cost of therapy as a percentage of the average urban household income		Cost of therapy as a percentage of the monthly household health expenditure by the public sector		Cost of therapy as a percentage of the monthly household health expenditure by the private sector	
Drug by Class	Dose	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available
Ace Inhibitors											
Captopril	25 mg	0.573	0.605	1.27	1.34	1.07	1.13	38.46	40.60	7.37	7.78
	100 mg	2.293	2.420	5.09	5.37	4.30	4.54	153.86	162.41	29.47	31.10
Enalapril	5 mg	0.955	1.146	2.12	2.54	1.79	2.15	64.11	76.93	12.28	14.73
	20 mg	3.821	4.585	8.48	10.18	7.17	8.60	256.43	307.72	49.11	58.93
Lisinopril	5 mg	1.910	3.114	4.24	6.91	3.58	5.84	128.22	208.99	24.56	40.03
	20 mg	7.642	12.456	16.96	27.64	14.33	23.36	512.87	835.97	98.22	160.10
Ramipril	1.25 mg		1.353		3.00		2.54		90.82		17.39
	5 mg		5.413		12.01		10.15		363.28		69.57
A2 Receptor Blockers											
Losartan	50 mg	2.675	4.967	5.94	11.02	5.02	9.32	179.50	333.36	34.38	63.84
	100 mg	5.349	9.934	11.87	22.05	10.03	18.63	359.01	666.72	68.76	127.69
Beta Blockers											
Propranolol	40 mg	0.611	0.892	1.36	1.98	1.15	1.67	41.03	59.83	7.86	11.46
	160 mg	2.445	3.566	5.43	7.91	4.59	6.69	164.12	239.34	31.43	45.84
Metoprolol	100 mg	0.955	1.656	2.12	3.67	1.79	3.11	64.11	111.12	12.28	21.28
	200 mg	1.910	3.311	4.24	7.35	3.58	6.21	128.22	222.24	24.56	42.56
Atenolol	50 mg	0.700	1.325	1.55	2.94	1.31	2.48	47.01	88.90	9.00	17.03
	100 mg	1.274	2.375	2.83	5.27	2.39	4.45	85.48	159.42	16.37	30.53
Ca Channel Blockers											
Nifedipine	20 mg	0.070	0.120	0.16	0.27	0.13	0.23	4.70	8.05	0.90	1.54
	80 mg	0.280	0.500	0.62	1.11	0.53	0.94	18.79	33.56	3.60	6.43

Continued.....

Drug by Class	Dose	Monthly cost of therapy		Cost of therapy as a percentage of the average rural household income		Cost of therapy as a percentage of the average urban household income		Cost of therapy as a percentage of the monthly household health expenditure by the public sector		Cost of therapy as a percentage of the monthly household health expenditure by the private sector	
		Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available
Amlodipine	5 mg	0.446	3.057	0.99	6.78	0.84	5.73	29.92	205.15	5.73	39.29
	10 mg	0.892	6.113	1.98	13.57	1.67	11.47	59.83	410.29	11.46	78.58
Felodipine	5 mg	1.465	2.197	3.25	4.88	2.75	4.12	98.30	147.45	18.83	28.24
	20 mg	5.859	8.788	13.00	19.50	10.99	16.48	393.20	589.79	75.30	112.96
Diltiazem	60 mg	1.700	2.400	3.77	5.33	3.19	4.50	114.09	161.07	21.85	30.85
	360 mg	10.200	14.700	22.64	32.62	19.13	27.57	684.56	986.58	131.11	188.95
Verapamil	240 mg		21.206		47.06		39.77		1423.20		272.57
	480 mg		42.411		94.12		79.54		2846.40		545.13
Diuretics											
Indapamide	2.5 mg	1.305	3.260	2.90	7.24	2.45	6.11	87.61	218.82	16.78	41.91
Furosemide	20 mg		0.135		0.30		0.25		9.06		1.74
	40 mg		0.270		0.60		0.51		18.12		3.47
Spironolactone	100 mg		3.240		7.19		6.08		217.45		41.65
	200 mg		6.480		14.38		12.15		434.90		83.29
Hydrochlorothiazide	50 mg		0.030		0.07		0.06		2.01		0.39
Methyldopa	250 mg	1.337	2.000	2.97	4.44	2.51	3.75	89.75	134.20	17.19	25.70
	3 g	16.048	23.995	35.61	53.25	30.10	45.00	1077.02	1610.40	206.27	308.42
Statins											
Lovastatin	20 mg	1.974	3.846	4.38	8.54	3.70	7.21	132.49	258.14	25.37	49.44
	80 mg	7.896	15.385	17.52	34.14	14.81	28.85	529.96	1032.57	101.50	197.75
Simvastatin	10 mg	3.197	7.005	7.09	15.55	6.00	13.14	214.55	470.13	41.09	90.04

Continued.....

Drug by Class	Dose	Monthly cost of therapy		Cost of therapy as a percentage of the average rural household income		Cost of therapy as a percentage of the average urban household income		Cost of therapy as a percentage of the monthly household health expenditure by the public sector		Cost of therapy as a percentage of the monthly household health expenditure by the private sector	
		Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available
Simvastatin	40 mg	12.787	28.020	28.38	62.18	23.98	52.55	858.19	1880.51	164.36	360.15
Atorvastatin	10 mg	10.189	11.463	22.61	25.44	19.11	21.50	683.82	769.30	130.96	147.33
	40 mg	40.756	45.850	90.45	101.75	76.44	85.99	2735.28	3077.19	523.85	589.33
Cerivastatin	0.4 mg		5.731		12.72		10.75		384.65		73.67
	0.8 mg		11.463		25.44		21.50		769.30		147.33
Fibric acid derivatives											
Gemfibrozil	600 mg		13.373		29.68		25.08		897.51		171.89
	900 mg		20.059		44.52		37.62		1346.27		257.83
	1.5 g		33.432		74.20		62.70		2243.78		429.72
Fenofibrate	200 mg		6.750		14.98		12.66		453.03		86.76
Bezafibrate	200 mg		2.786		6.18		5.23		186.98		35.81
	600 mg		8.358		18.55		15.68		560.95		107.43
Niacin											
Niacin	500 mg		1.178		2.61		2.21		79.07		15.14
	1.5 g		3.534		7.84		6.63		237.20		45.43
	6 g		14.137		31.37		26.51		948.80		181.71
BANGLADESH											
Ace Inhibitors											
Captopril	25 mg	1.30	1.56	2.05	2.46	0.94	1.13	55.13	66.15	49.28	59.13
	100 mg	5.204	6.245	8.20	9.84	3.76	4.52	220.50	264.60	197.11	236.54
Enalapril	5 mg	0.520	0.781	0.82	1.23	0.38	0.56	22.05	33.08	19.71	29.57

Continued.....

Drug by Class	Dose	Monthly cost of therapy		Cost of therapy as a percentage of the average rural household income		Cost of therapy as a percentage of the average urban household income		Cost of therapy as a percentage of the monthly household health expenditure by the public sector		Cost of therapy as a percentage of the monthly household health expenditure by the private sector	
		Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available
Enalapril	20 mg	2.082	3.122	3.28	4.92	1.51	2.26	88.20	132.30	78.85	118.27
Lisinopril	5 mg	1.405	2.082	2.21	3.28	1.02	1.51	59.54	88.20	53.22	78.85
	20 mg	5.620	8.326	8.86	13.12	4.06	6.02	238.14	352.80	212.88	315.38
Ramipril	1.25 mg	1.041	1.561	1.64	2.46	0.75	1.13	44.10	66.15	39.42	59.13
	5 mg	4.163	6.245	6.56	9.84	3.01	4.52	176.10	264.60	157.69	236.54
A2 Receptor Blockers											
Losartan	50 mg	2.602	3.122	4.10	4.92	1.88	2.26	110.25	132.30	98.56	118.27
	100 mg	5.204	6.245	8.20	9.84	3.76	4.52	220.50	264.60	197.11	236.54
Valsartan	80 mg		16.132		25.42		11.66		683.55		611.05
	160 mg		32.264		50.85		23.33		1367.10		1222.11
Beta Blockers											
Propranolol	40 mg	0.520	0.208	0.82	0.33	0.38	0.15	22.05	8.82	19.71	7.88
	160 mg	2.082	24.978	3.28	39.37	1.51	18.06	88.20	1058.40	78.85	946.15
Metoprolol	100 mg		0.676		1.07		0.49		28.67		25.62
	200 mg		1.353		2.13		0.98		57.33		51.25
Atenolol	50 mg		0.390		0.62		0.28		16.54		14.78
	100 mg		0.703		1.11		0.51		29.77		26.61
Ca Channel Blockers											
Nifedipine	20 mg		5.250		8.27		3.80		222.46		198.86
	80 mg		21.000		33.10		15.18		889.83		795.45
Amlodipine	5 mg	1.561	2.602	2.46	4.10	1.13	1.88	66.15	110.25	59.13	98.56
	10 mg	3.122	5.204	4.92	8.20	2.26	3.76	132.30	220.50	118.27	197.11

Continued.....

Drug by Class	Dose	Monthly cost of therapy		Cost of therapy as a percentage of the average rural household income		Cost of therapy as a percentage of the average urban household income		Cost of therapy as a percentage of the monthly household health expenditure by the public sector		Cost of therapy as a percentage of the monthly household health expenditure by the private sector	
		Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available
Diltiazem	60 mg		2.082		3.28		1.51		88.20		78.85
	360 mg		12.489		19.68		9.03		529.20		473.07
Verapamil	240 mg		4.423		6.97		3.20		187.43		167.55
	480 mg		8.846		13.94		6.40		374.85		335.09
Diuretics											
Indapamide	2.5 mg		4.007		6.32		2.90		169.79		151.78
Furosemide	20 mg		0.130		0.21		0.09		5.51		4.93
	40 mg		0.260		0.41		0.19		11.03		9.86
Spironolactone	100 mg		5.204		8.20		3.76		220.50		197.11
	200 mg		10.408		16.40		7.53		441.00		394.23
Hydrochlorothiazide	50 mg	0.312	0.338	0.49	0.53	0.23	0.24	13.23	14.33	11.83	12.81
Methyldopa	250 mg		0.885		1.39		0.64		37.49		33.51
	3 g		10.616		16.73		7.68		449.82		402.11
Statins											
Lovastatin	20 mg		5.204		8.20		3.76		220.50		197.11
	80 mg		20.815		32.81		15.05		882.00		788.46
Fluvastatin	20 mg		10.408		16.40		7.53		441.00		394.23
	80 mg		41.631		65.61		30.10		1764.01		1576.91
Simvastatin	10 mg	2.862	3.903	4.51	6.15	2.07	2.82	121.28	165.38	108.41	147.84
	40 mg	11.448	15.611	18.04	24.60	8.28	11.29	485.10	661.50	433.65	591.34
Atorvastatin	10 mg	11.709	14.831	18.45	23.37	8.47	10.72	496.13	628.43	443.51	561.78
	40 mg	46.834	59.324	73.81	93.50	33.86	42.89	1984.51	2513.71	1774.03	2247.10

Continued.....

Drug by Class	Dose	Monthly cost of therapy		Cost of therapy as a percentage of the average rural household income		Cost of therapy as a percentage of the average urban household income		Cost of therapy as a percentage of the monthly household health expenditure by the public sector		Cost of therapy as a percentage of the monthly household health expenditure by the private sector	
		Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available
Fibric acid derivatives											
Gemfibrozil	900 mg		5.464		8.61		3.95		231.53		206.97
	1.5 mg		9.107		14.35		6.58		385.88		344.95
NEPAL											
Ace Inhibitors											
Captopril	25 mg	1.041	2.003	2.05	3.95	1.39	2.68	94.24	181.24	29.17	56.10
	100 mg	4.166	8.011	8.21	15.79	5.57	10.71	376.97	724.95	116.68	224.39
Enalapril	5 mg	0.681	1.242	1.34	2.45	0.91	1.66	61.62	112.37	19.07	34.78
	20 mg	2.724	4.967	5.37	9.79	3.64	6.64	246.48	449.47	76.29	139.12
Lisinopril	5 mg	2.283	2.323	4.50	4.58	3.05	3.11	206.61	210.24	63.95	65.07
	20 mg	9.132	9.292	18.00	18.32	12.21	12.43	826.44	840.94	255.80	260.29
Ramipril	1.25 mg		1.362		2.68		1.82		123.24		38.15
	5 mg		5.447		10.74		7.29		492.96		152.58
A2 Receptor Blockers											
Losartan	50 mg	1.402	2.603	2.76	5.13	1.87	3.48	126.87	235.61	39.27	72.93
	100 mg	2.804	5.207	5.53	10.26	3.75	6.96	253.73	471.22	78.54	145.85
Beta Blockers											
Propranolol	40 mg	0.761	1.065	1.50	2.10	1.02	1.42	68.87	96.42	21.32	29.84
	160 mg	3.044	4.262	6.00	8.40	4.07	5.70	275.48	385.67	85.27	119.37
Metoprolol	100 mg	1.442	1.602	2.84	3.16	1.93	2.14	130.49	144.99	40.39	44.88
	200 mg	2.884	3.204	5.68	6.32	3.86	4.29	260.98	289.98	80.78	89.76
Atenolol	50 mg	0.841	1.330	1.66	2.62	1.12	1.78	76.12	120.34	23.56	37.25
	100 mg	2.083	2.411	4.11	4.75	2.79	3.22	188.49	218.21	58.34	67.54

Continued.....

Drug by Class	Dose	Monthly cost of therapy		Cost of therapy as a percentage of the average rural household income		Cost of therapy as a percentage of the average urban household income		Cost of therapy as a percentage of the monthly household health expenditure by the public sector		Cost of therapy as a percentage of the monthly household health expenditure by the private sector	
		Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available
Ca Channel Blockers											
Nifedipine	20 mg	18.000	19.500	35.48	38.44	24.07	26.08	1628.96	1764.71	504.20	546.22
	80 mg	72.000	78.000	141.93	153.76	96.30	104.32	6515.84	7058.82	2016.81	2184.87
Amlodipine	5 mg	0.801	3.012	1.58	5.94	1.07	4.03	72.49	272.58	22.44	84.37
	10 mg	1.602	6.024	3.16	11.87	2.14	8.06	144.99	545.16	44.88	168.74
Diltiazem	60 mg	2.123	2.724	4.18	5.37	2.84	3.64	192.11	246.48	59.46	76.29
	360 mg	12.737	16.342	25.11	32.21	17.03	21.86	1152.67	1478.89	356.78	457.75
Verapamil	240 mg	2.163	3.485	4.26	6.87	2.89	4.66	195.74	315.35	60.58	97.61
	480 mg	4.326	6.969	8.53	13.74	5.79	9.32	391.47	630.71	121.17	195.22
Diuretics											
Furosemide	20 mg		0.100		0.20		0.13		9.06		2.80
	40 mg		0.200		0.39		0.27		18.12		5.61
Spironolactone	100 mg		3.381		6.66		4.52		305.93		94.69
	200 mg		6.761		13.33		9.04		611.86		189.38
Methyldopa	250 mg		1.602		3.16		2.14		144.99		44.88
	3 g		19.226		37.90		25.71		1739.88		538.53
Statins											
Lovastatin	20 mg	4.486	13.458	8.84	26.53	6.00	18.00	405.97	1217.91	125.66	376.97
	80 mg	17.944	53.832	35.37	106.11	24.00	72.00	1623.88	4871.65	502.63	1507.89
Simvastatin	10 mg		3.905		7.70		5.22		353.41		109.39

Continued.....

Drug by Class	Dose	Monthly cost of therapy		Cost of therapy as a percentage of the average rural household income		Cost of therapy as a percentage of the average urban household income		Cost of therapy as a percentage of the monthly household health expenditure by the public sector		Cost of therapy as a percentage of the monthly household health expenditure by the private sector	
		Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available
Simvastatin	40 mg		15.621		30.79		20.89		1413.65		437.56
Fibric acid derivatives											
Gemfibrozil	900 mg		18.601		36.67		24.88		1683.33		521.03
	1.5 g		31.001		61.11		41.46		2805.55		868.38
Bezafibrate	200 mg		4.746		9.36		6.35		429.53		132.95
	600 mg		14.239		28.07		19.04		1288.60		398.85
SRI LANKA											
Ace Inhibitors											
Captopril	25 mg	2.00	2.99	3.00	4.50	1.50	2.25	37.09	55.64	30.56	45.84
	100 mg	7.98	11.97	12.00	18.00	6.00	9.00	148.37	222.55	122.24	183.36
Enalapril	5 mg	1.33	8.31	2.00	12.50	1.00	6.25	24.73	154.55	20.37	127.33
	20 mg	5.32	33.26	8.00	50.00	4.00	25.00	98.91	618.20	81.49	509.33
Lisinopril	5 mg	1.33	14.97	2.00	22.50	1.00	11.25	24.73	278.19	20.37	229.20
	20 mg	5.32	59.87	8.00	90.00	4.00	45.00	98.91	1112.77	81.49	916.80
Ramipril	1.25 mg		0.83		1.25		0.62		15.46		12.73
	5 mg		3.33		5.00		2.50		61.82		50.93
A2 Receptor Blockers											
Losartan	50 mg	3.99	4.99	6.00	7.50	3.00	3.75	74.18	92.73	61.12	76.40
	100 mg	7.98	9.98	12.00	15.00	6.00	7.50	148.37	185.46	122.24	152.80
Valsartan	80 mg		26.61		40.00		20.00		494.56		407.47
	160 mg		53.22		80.00		40.00		989.13		814.93

Continued.....

Drug by Class	Dose	Monthly cost of therapy		Cost of therapy as a percentage of the average rural household income		Cost of therapy as a percentage of the average urban household income		Cost of therapy as a percentage of the monthly household health expenditure by the public sector		Cost of therapy as a percentage of the monthly household health expenditure by the private sector	
		Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available
Beta Blockers											
Propranolol	40 mg		0.13		0.20		0.10		2.47		2.04
	160 mg		0.53		0.80		0.40		9.89		8.15
Metoprolol	100 mg	2.33	4.99	3.50	7.50	1.75	3.75	43.27	92.73	35.65	76.40
	200 mg	4.66	9.98	7.00	15.00	3.50	7.50	86.55	185.46	71.31	152.80
Atenolol	50 mg	0.67	9.31	1.00	14.00	0.50	7.00	12.36	173.10	10.19	142.61
	100 mg	1.33	14.97	2.00	22.50	1.00	11.25	24.73	278.19	20.37	229.20
Ca Channel Blockers											
Nifedipine	20 mg		15.00		22.55		11.27		278.81		229.71
	80 mg		60.00		90.20		45.10		1115.24		918.84
Amlodipine	5 mg	2.00	14.97	3.00	22.50	1.50	11.25	37.09	278.19	30.56	229.20
	10 mg	3.99	29.93	6.00	45.00	3.00	22.50	74.18	556.38	61.12	458.40
Felodipine	5 mg	2.49	3.16	3.75	4.75	1.87	2.37	46.37	58.73	38.20	48.39
	10 mg	4.99	6.32	7.50	9.50	3.75	4.75	92.73	117.46	76.40	96.77
	20 mg	9.98	12.64	15.00	19.00	7.50	9.50	185.46	234.92	152.80	193.55
Diltiazem	60 mg	1.00	2.00	1.50	3.00	0.75	1.50	18.55	37.09	15.28	30.56
	360 mg	5.99	11.97	9.00	18.00	4.50	9.00	111.28	222.55	91.68	183.36
Verapamil	240 mg		0.80		1.20		0.60		14.84		12.22
	480 mg		1.60		2.40		1.20		29.67		24.45
Diuretics											
Indapamide	2.5 mg		6.32		9.50		4.75		117.46		96.77
Furosemide	20 mg	0.07	0.33	0.10	0.50	0.05	0.25	1.24	6.18	1.02	5.09

Continued.....

Drug by Class	Dose	Monthly cost of therapy		Cost of therapy as a percentage of the average rural household income		Cost of therapy as a percentage of the average urban household income		Cost of therapy as a percentage of the monthly household health expenditure by the public sector		Cost of therapy as a percentage of the monthly household health expenditure by the private sector	
		Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available	Minimum available	Maximum available
Furosemide	40 mg	0.13	0.67	0.20	1.00	0.10	0.50	2.47	12.36	2.04	10.19
Spironolactone	100 mg	1.00	3.33	1.50	5.00	0.75	2.50	18.55	61.82	15.28	50.93
	200 mg	2.00	6.65	3.00	10.00	1.50	5.00	37.09	123.64	30.56	101.87
Hydrochlorothiazide	50 mg		0.07		0.10		0.05		1.24		1.02
Methyldopa	250 mg	2.00	3.99	3.00	6.00	1.50	3.00	37.09	74.18	30.56	61.12
	3 g	23.95	47.89	36.00	72.00	18.00	36.00	445.11	890.22	366.72	733.44
Statins											
Lovastatin	20 mg	3.33	13.30	5.00	20.00	2.50	10.00	61.82	247.28	50.93	203.73
	80 mg	13.30	53.22	20.00	80.00	10.00	40.00	247.28	989.13	203.73	814.93
Simvastatin	10 mg	6.65	19.96	10.00	30.00	5.00	15.00	123.64	370.92	101.87	305.60
	40 mg	26.61	79.82	40.00	120.00	20.00	60.00	494.56	1483.69	407.47	1222.40
Atorvastatin	10 mg	8.31	16.63	12.50	25.00	6.25	12.50	154.55	309.10	127.33	254.67
	40 mg	33.26	66.52	50.00	100.00	25.00	50.00	618.20	1236.41	509.33	1018.67
Fibric acid derivatives											
Gemfibrozil	900 mg	4.49	7.48	6.75	11.25	3.37	5.62	83.46	139.10	68.76	114.60
	1.5 g	7.48	12.47	11.25	18.75	5.62	9.37	139.10	231.83	114.60	191.00

APPENDIX B

A Heart Healthy Eating Plan for South Asians

We recommend that health professionals use this guide while recommending a healthy eating plan.

Lean meat, poultry and fish

Daily allowance: a serving a day from this group; where applicable and possible at least 2 of these daily servings a week should be of fish. It is preferable to avoid beef. Fat should always be trimmed off meat (except fish meat) before cooking.

- One serving of beef or mutton is equal to 3 full size botis.[1]
- One serving of chicken is ½ a chicken breast or chicken leg with thigh (without skin).
- One serving of fish is the size of a deck of playing cards.
- A one-cup serving of cooked beans, peas or lentils (masur, maash, channay, lobia), chick peas (cholay), can replace a serving of meat.

Eggs

Daily allowance: due to the high cholesterol content of egg yolks, as a general rule, if one egg is eaten then cholesterol in any other form through oils, meat or dairy products, should be reduced. However, egg white is a very good source of protein, has no cholesterol and can be taken daily.

Fruits and vegetables

Daily allowance: 5 or more servings a day.

- One serving is equal to 1 medium-size piece of fruit (e.g. small apple, small banana) or ½-1 cup cooked or raw vegetables.
- Coconuts are very high in saturated fat and should be eaten only very occasionally. Jaggery (palm sugar – made from the sap of the coconut palm) is a high calorie item and should be eaten only as a treat.

[1] A standard size for pieces of meat used in a curry.

Low fat milk products

Daily allowance: servings per day depend on age; for adults aged 19 and above, 2 servings a day are recommended.
One serving is 1 cup of fat-free (packaged) or fresh milk with the cream removed **or** 1 cup yogurt made with such milk **or** 1 oz. Low- fat cheese or ½ cup low fat cottage cheese.

Breads, cereals, pasta and starchy vegetables

Daily allowance: 6 servings a day.

- One serving is equal to one slice of bread, one chapatti or dosa (size of a small plate), half a naan (saada not roghni), idli, makki ki roti, etc. **or** 1 cup of cooked rice or pasta **or** ¼ - ½ cup of starchy vegetables (potatoes, corn, green peas, sweet potatoes).

Fats and Oils

Daily allowance: No more than a total of 2-4 servings per day.

- One serving is 1 tbsp. of vegetable oil like canola, corn, olive, safflower, sesame, soybean and sunflower.
- **or** 1 ½ tsp. of seeds or nuts like almonds, walnuts, pine nuts, pistas, cashew nuts, peanuts.
- Note: Remember that all home made or commercially prepared baked and processed foods like cakes, buns, doughnuts, mithai, sweet dishes, and biscuits contain fat in the form of butter, ghee, or oil. This must be taken into account in the servings per day.
- Avoid ghee, coconut, palm kernel and palm oil (all solid at room temperature) as they are very high in saturated fats and should be avoided.
- In Sri Lanka coconut oil is very widely used; its use should be discouraged.

Recommendations for Diabetics:

In addition to the above, foods that have a high content of sugar like sugar itself or foods containing high concentrations of sugar are to be avoided. Also to be avoided are very sweet fruits like mangoes, dates, melons and grapes.

APPENDIX C

Methodology

At the executive council meeting of the SAARC Cardiac Society held in Kathmandu, Nepal on July 22, 2000, it was unanimously decided to develop a set of "Guidelines for the Prevention of Coronary Heart Diseases in the SAARC Region". The executive council selected the chief coordinator to steer the development of the guidelines at a central level and regional coordinators to steer input at regional levels in addition to liaising with the chief coordinator. It was also decided that all the members of the SAARC executive council would serve as the SAARC consensus panel, and that the regional coordinators should set up regional consensus panels in their own countries. It was also agreed upon that an international advisory board should be constituted which would give its input to the final draft of the manuscript.

The preparation phase consisted of pre-evaluation surveys, literature review, writing up the report, and input at different levels.

Pre-evaluation Survey

Focus group discussions held independently in India, Pakistan and Bangladesh were employed as part of the pre-evaluation survey that guided the development of these guidelines with respect to its justification, format and content. A field guide was developed which sought responses relating to the relevance of these guidelines to practice in the region and the level of knowledge and beliefs of the health care providers.

Bangladesh: in Bangladesh a focus group discussion was held with the participation of eight cardiologists and cardiovascular epidemiologists on September 28, 2000. The focus group summarized a review of literature on the prevalence of coronary heart disease within the country, in addition to furnishing details regarding the currently recommended national guidelines for primary and secondary prevention.

India: the group in India felt that the recommendations should flow from a broad based group both in terms of professional involvement as well as

representation from various regions of the country and therefore the views of eminent experts all over the country were solicited. This was thought to be a good surrogate to focus group discussion, which was logistically impractical due to geographic constraints.

There was near unanimity in the need for the guidelines and also for region specificity. Most respondents felt that the western guidelines were not ideally suited to or were either inadequate or inappropriate in the Indian context. Almost all the respondents were aware of the global CVD trends to a varying extent and believed that the trend had serious implications for the SAARC countries and therefore emphasized upon the need to develop and disseminate guidelines focusing on prevention. Input with regard to diet, physical activity and stress as part of the feedback, has been useful while drawing up the recommendations. It was identified that policy change was essential for bringing CVD on the health care agendas of the SAARC countries. The importance of coordinating efforts within the SAARC countries was also emphasized.

Pakistan: in Pakistan feedback was sought through questionnaires from cardiologists, general physicians, epidemiologists, dietitians and heath policy makers. Majority of the participants of the focus group discussion found this exercise relevant within the framework of the regional health economics. It was agreed unanimously that investment in prevention for the region is imperative. There was a general agreement on the need to customize guidelines with a focus on economic issues while still working within the domain of scientific recommendations. A case was made for economically tiering these guidelines. Input relating to dietary recommendations was also received from the participants, as a result of which the Heart Healthy Eating plan for South Asians has been developed and is appended. With regard to the antismoking strategies, there were differing opinions. Some participants were inclined toward an aggressive policy-based approach whereas others favored a program-based strategy. Integration of physical activity as part of the heart health package was generally visualized as a problem for women; it was emphasized that this issue be addressed appropriately, in keeping with religious and cultural sensitivities.

All participants saw pharmaceutical multinational distribution networks as a support structure and a possible conduit for the dissemination of these

guidelines but expressed a concern over potential conflict of interest particularly as these guidelines were seen as intending to decrease rather than encourage prescription expense. In this context all participants suggested using alternate means of disseminating these guidelines and highlighted the potential role of training trainers with support from the private and the public sector.

After the focus group discussions and literature review, the chief coordinator prepared the initial draft, which was approved by the SAARC consensus panel members at the executive council meeting of the SAARC cardiac society in Chennai, India on December 9, 2000. Over the following months feedback received from the members of the International Advisory Board was also incorporated into the document.

GLOSSARY

ATP:	Adult Treatment Panel
ACE:	Angiotensin Converting Enzyme
BMI:	Body Mass Index
CAD:	Coronary Artery Disease
CHD:	Coronary Heart Disease
COT:	Cigarette and Other Forms of Tobacco Use
CVD:	Cardiovascular Disease
CRP:	C-Reactive Protein
DALY:	Daily Adjusted Life Years
GNP:	Gross National Product
GDP:	Gross Domestic Product
HDL:	High Density Lipoprotein
ICT:	Information Communication Technology
JNC:	Joint National Committee criteria
LDL:	Low Density Lipoprotein
Lp(a):	Lipoprotein A
NCD:	Non Communicable Diseases
NRT:	Nicotine Replacement Therapy
PAI:	Platelet Activation Inhibitor
SES:	Socio-Economic Strata
TC:	Total Cholesterol
TG:	Triglycerides