

BODY OF REPORT

SEATO CRC Study No. 1 Survey: Incidence and Etiology of Heart Disease in Thailand

Project No. 3A 025601 A 811 Military Medical Research Program
S. E. Asia

Task 01: Military Medical Research Program
S. E. Asia

Subtask 01: Military Medical Research Program
SEASIA (Thailand)

Reporting Installation: US Army-SEATO Medical Research Laboratory
APO San Francisco 96346

 Division of Clinical Research

 Department of Clinical Studies

Period Covered by Report: 1 April 1964 to 31 March 1965

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Reports Control Symbol: MEDDH-288

Security Classification: UNCLASSIFIED

Objectives: The objectives of this study are to describe the electrocardiographic and cardiac physical findings of normal Thai, and to derive an order of magnitude estimate of the prevalence and etiologic types of heart disease found in the Bangkok area.

Description: Cardiovascular evaluations were carried out on 570 subjects seen in the Bang Khaen, Huay Kwang and Yanawa districts of Bangkok in connection with studies of anemia and vitamin E metabolism. Physical findings were tabulated on 150 subjects seen personally by two of us (R.A.O. and S.K-S.).

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Table 1

Age	0-5	6-10	11-20	21-40	40
No. Pts.	34	27	18	41	30
P2 A2	33	27	16	28	14
S3	6	14	7	2	-
Apical murmur	7	14	7	20	9
Basal murmur	7	15	10	8	4
Arcus	6/23	7/11	3/6	18/21	10/10

None had physical or electrocardiographic evidence of heart disease. Electrocardiograms adequate for interpretation were obtained in 507 subjects. Further cardiovascular studies were carried out on subjects suspected of having heart disease on clinical and electrocardiographic grounds. Eight subjects in this category were lost to follow-up or refused any further studies, so that the estimate of the prevalence of heart disease is based on 499 subjects.

Physical findings which were evaluated included blood pressure, relative loudness and separation of semilunar valve closure sounds, occurrence of third and fourth heart sounds, presence and characteristics of murmurs, and presence of arcus senilis.

Standard 12-lead electrocardiograms were obtained with either Sanborn Model 100 or 300 electrocardiograms at paper speed of 25 mm/sec. Recording and measurements were made in accordance with the recommendations of the New York Heart Association. The following data were tabulated: age, heart rate, QRS axis, PR interval, QT interval, inscription of Frontal plane QRS Loop, precordial transition zone precordial T wave inversion, and the voltages of the following deflections: Rv_1 , Sv_1 , Rv_5 , and Sv_5 . The following were computed: PR index (in subjects under 12 years of age), corrected QT interval $Rv_1 + Sv_5$, $Rv_5 + Sv_1$, $Rv_1/(Rv_1 + Sv_1)$, and $Rv_5 + Sv_5$.

Subjects suspected of having heart disease on clinical or electrocardiographic grounds were requested to come for definitive studies including cardiac catheterization where indicated.

Progress: Physical Findings. The important results of this phase of the study are summarized in Table 1. In Caucasians the aortic and pulmonic valve closure sounds are approximately equal in intensity at about 20 years of age, after which the aortic sound is louder. The normal third heart sound (S3) is rarely heard in adulthood. In these subjects, however, loud pulmonic sounds were heard frequently among adults. A third sound was heard in only two of the 71 subjects over the age of 20.

Systematic evaluation for arcus senilis was not begun until midway in the study when it was apparent that this was occurring with impressive frequency. Although only 71 subjects were examined, arcus senilis was found in 44, with the prevalence apparently increasing with age. Funduscopic examination after dilating the pupils was performed successfully in 55 of the subjects over the age of 20. Increased light reflex was observed in 20, but none had "silver wire" changes or tortuosity.

Electrocardiographic data on PR, QRS, and QT intervals were generally unremarkable. The changes in mean QRS axis with age resembled those seen in Caucasians. Adults with clockwise inscription of the frontal plane QRS loop were seen much more frequently than in Caucasians. The prevalence of a clockwise loop was 60 per cent in subjects 16-25 years of age, 43 per cent in the 26-40 years age group, and 36 per cent in subjects over 40.

T wave inversion in precordial leads to the left of V₁ is common in Caucasian children, but is rarely seen above 10 years of age. Fifty-four per cent of the subjects between 12 and 15 years of age had T wave inversion extending to V₂, V₃ or V₄. The prevalence decreased in older age groups, but was still 17 per cent in the subjects over 40.

Precordial lead voltages generally fell in the normal range for Caucasians, with one notable exception: R/S ratios of greater than unity were encountered frequently among children and occasionally among adults, without electrocardiographic, clinical or radiologic evidence of heart disease.

The estimate of the prevalence of heart disease is not yet complete. Table 2 summarizes the findings in the 14 subjects shown or suspected of having heart disease. The prevalence in this group of 3 per cent is strikingly higher than comparable populations elsewhere. Only 1 subject had evidence of arteriosclerotic heart disease, while 8 have definite physical, radiologic and electrocardiographic evidence of congenital heart disease. Two additional subjects are suspected of having myocardopathy and one of having congenital heart disease, but are to be followed rather than catheterized at this time.

Summary and Conclusions: The physical and electrocardiographic findings in these apparently normal subjects suggest that characteristics normally associated with childhood persist for longer than is the case in Caucasian populations. The evolution of the electrocardiogram, in particular, is retarded, and many subjects

Table 2

No.	Age	Sex	Findings	Disposition
1	6	M	Acyanotic Tetralogy of Fallot (by catheterization)	Surgery
2	14	M	EKG: RAD, "Diamond-shaped" pulmonic murmur. X-ray normal. Tentative diagnosis: Pulmonic stenosis.	Catheterization Pending
3	12	F	EKG: LVH; X-ray: cardiomegaly. No murmur Mentally retarded. Tentative diagnosis: Myocardiopathy	Periodic Re-examination
4	80	F	EKG: PR 0.22, otherwise not remarkable. Physical and X-ray normal.	Periodic Re-examination
5	52	F	EKG: PR 0.22, otherwise not remarkable. Physical and X-ray normal.	Periodic Re-examination
6	6	M	EKG: RAD. "Diamond-shaped" systolic murmur in 4th ICS at LSB. Tentative diagnosis: VSD ?	Catheterization upon return to Bangkok
7	3	M	Combined ventricular hypertrophy with large aortic knob. Tentative diagnosis: Patent ductus.	Catheterization Scheduled
8	7	F	EKG: LAD, ? RVH No murmurs. Tentative diagnosis: Atrial septal defect.	Catheterization Scheduled
9	24	F	EKG: 1 ^o H.B. Loud pulmonic systolic murmur. Tentative diagnosis: VSD with PS.	Catheterization Schedule
10	7	F	EKG and P.E.: RVH. Pulmonic murmur X-ray normal. Tentative diagnosis: Atrial septal defect.	Periodic Follow-up
11	7	M	EKG and P.E.: RVH. No murmurs X-ray normal. Tentative diagnosis: myocardiopathy.	Periodic Follow-up
12	9	F	EKG: RVH and LVH. Pulmonic systolic murmur Tentative diagnosis: ? Patent Ductus	Catheterization Pending
13	29	F	EKG: Chronic bigeminy. X-ray shows unilateral hyperlucent lung. Tentative diagnosis: deferred.	Pulmonary workup
14	7	M	PE and EKG: RVH. Tentative diagnosis: RVH, possible atrial septal defect	Catheterization Scheduled
15	66	F	EKG: Pathologic Q waves in leads 2, 3 and aVF. Diagnosis: Myocardial infarction.	Periodic Re-examination

had patterns suggestive of congenital heart disease. The factors responsible for this have not been established. This population differs from that in the U.S. in that anemia is very common (Cf. CRC Study No.2), and hypertension and coronary artery disease are quite rare. Only 3 subjects in this study had diastolic blood pressures of 90 mmHg; none had higher.

The frequent occurrence of arcus senilis, even among children, is of interest. The mean blood cholesterol value in 38 adults studied in the ICNND survey was 132 mg/100 ml. Although no cholesterol data have been obtained in the subjects of this survey, it is doubtful if they would differ significantly. The presence of arcus senilis, apparently without hypercholesterolemia, is reminiscent of similar findings in the Alaskan Eskimo, and deserves further study.

The prevalence of heart disease among these subjects is on the order of 3 per cent, a remarkably high figure. There is strong clinical evidence for congenital heart disease in over half of these subjects. Surprisingly, rheumatic heart disease was not encountered among the subjects studied, yet it is an extremely common condition in this country. Although not included in this report, 5 subjects with murmurs pathognomonic for mitral stenosis, aortic insufficiency of mitral insufficiency were found elsewhere in Thailand among the subjects of CRC Study No. 2, a prevalence of 0.7 per cent.

It should be pointed out that these estimates of the prevalence of heart disease are minimum figures, and do not account for these subjects dying of heart disease before the time of examination, i.e. neonatal and infant death from lesions incompatible with life. The absence of any cases of cyanotic heart disease is evidence that such a process may have taken place. Likewise, the absence of rheumatic heart disease in this sample suggests that perhaps these subjects either died or received treatment elsewhere.