Prevalence of Cardiac Arrhythmias in Thai Young Employees

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Abstract: *Background.* Since 1887, the electrocardiogram (ECG) has been used in the diagnosis of cardiovascular disease. It is objective, simple, rapidly obtained, painless, and largely independent of cooperation or language differences. The ECG plays an important role as a screening test for cardiac arrhythmia. The objective of this study was to describe the prevalence of cardiac arrhythmia in apparently healthy middle-class subjects in a Thai community. *Methods and results.* The resting 12 lead electrocardiogram was recorded in 1,474 apparently healthy employees of Shinawat Corporation Company. There were 844 females and 630 males whose ages were 30 years or more (mean age 34.8 years). The prevalence rate of sinus bradycardia was 108.6 per thousand, sinus tachycardia 8.8 per thousand, sinus arrhythmia 10.9 per thousand, ventricular premature beats 8.8 per thousand, atrial premature beats 2.7 per thousand, atrial fibrillation 0.7 per thousand, Wolff-Parkinson-White pattern 2 per thousand, short PR interval without delta wave 4.7 per thousand, first degree AV block 15.6 per thousand, second degree AV block type I 0.7 per thousand, left anterior fasicular block 8.8 per thousand, left posterior fascicular block 1.4 per thousand and complete right bundle branch block 2 per thousand. The prevalence rates for incomplete right bundle branch block, AV dissociation, junctional rhythm and low atrial rhythm were all 0.7 per thousand. Complete left bundle branch block was not found in this study. *Conclusions.* This is a report of cardiac arrhythmia prevalences in Thai young employees recorded by resting 12 lead ECG. The prevalences in our study were lower than actual prevalences because we used only single 12 lead ECG to detect cardiac arrhythmia during a limited time frame.

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บทคัดย่อ: ความชุกของภาวะหัวใจเต้นผิดจังหวะของพนักงานบริษัท

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ผลการสำรวจคลื่นไฟฟ้าหัวใจของพนักงานบริษัทชินวัตร จำกัด ที่มีอายุ 30 ปีขึ้นไป จำนวน 1,474 ราย เป็น ชาย 630 ราย หญิง 844 ราย อายุเฉลี่ย 34.8 ปี พบภาวะหัวใจเต้นผิดจังหวะทั้งหมด 263 ราย (178 ต่อ 1,000 ราย)

ความชุกของภาวะหัวใจเต้นผิดจังหวะต่อประชากร 1,000 ราย มีดังต่อไปนี้ sinus bradycardia 108.6, sinus tachycardia 8.8, sinus arrhythmia 10.9, ventricular premature beats 8.8, atrial premature beats 2.7, atrial fibrillation 0.7, Wolff-Parkinson-White pattern 2, short PR interrval without delta wave 4.7, first degree AV block 15.6, second degree AV block type I 0.7, left anterior fascicular block 8.8, left posterior fascicular block 1.4, complete right bundle branch block 2, incomplete right bundle branch block 0.7, AV dissociation 0.7, junctional rhythm 0.7, low atrial rhythm 0.7, ไม่พบภาวะ left bundle branch block จากการศึกษานี้

Abbreviations:

ECG, electrocardiogram;

AF, atrial fibrillation;

PAC, premature atrial contraction;

PVC, premature ventricular contraction;

WPW, Wolff-Parkinson-White;

CRBBB & ICRBBB, complete and incomplete right bundle branch block;

LAFB & LPFB, left anterior and left posterior fascicular block;

1^0, 2^0 & 3^0 AVB, first, second and third degree atrioventricular blocks

Since 1887, the electrocardiogram (ECG) has been used in the diagnosis of cardiovascular disease[1]. It is objective, simple, rapidly obtained, painless, and largely independent of cooperation or language differences. The ECG plays an important role as a screening test for cardiac arrhythmia.

Much of the knowledge concerning electro-cardiographic findings is based on information obtained from hospital and clinic populations. Since a high percentage of these population have underlying cardiovascular disease, particularly those admitted into the cardiac service, they are pre-selected and biased populations. As a result, the prevalence of arrhythmias based on these populations may be higher than general population and may not represent for generalization of the population in the community. Less information has been obtained from healthy subjects.

There were three electrocardiographic surveys reported in Thailand before this study. One was done in children and was hospital based[2]. The other two studies were community based studies in normal Thais of both sex[3,4]. This report is a study of ECG in a selected population, middle class population in Bangkok. The objective of this study was to describe the prevalence of cardiac arrhythmia in apparently healthy middle class subject in a Thai population.

Materials and methods

Population

The subjects in this study were employees of Shinnawat Corporation Company aged 30 years and over. They all were in good health according to medical history and physical examination obtained by cardiologists.

Electrocardiograms

Standard supine 12-lead ECG were recorded using ECG equipment fulfilling the recommendations of the American Heart Association for technical specifications[5].

All ECG records (25 mm/second) were screened by two cardiologist for the following abnormal rhythm and conduction: arrhythmia of sinus node, atrium, atrio-ventricular junction and ventricle; first, second and third degree atrio-ventricular blocks (1^0, 2^0 & 3^0 AVB); right and left bundle branch block; left anterior (QRS axis - 40^0 to -90^0) and posterior (QRS axis +105^0 to +180^0) fascicular block (LAFB & LPFB); short PR interval and delta wave. If two types of arrhythmias coexisted, each of them was separately recorded. There were no difference in ECG interpretations between two cardiologists. The arrhythmia criteria was based on the standard ECG criteria[6].

Statistical analysis

Descriptive statistics were applied for rates. Chi-square was applied for comparison of prevalence between different age groups and sex. All p value were two sided, and the level of significance was 95%.

Results

The total population was 1,474 subjects and the

Table 1. Age-sex distribution of the study population.

Age group (yr)	Number		Total	Percent
	Male	Female		
30-34	323	585	908	61.6
35-39	171	178	349	23.7
>40	136	81	217	14.7
Total	630	844	1,474	100

distribution by age and sex was shown in Table 1. The mean age was 34.8 years with 85% of the population younger than 40 years old. There was a total of 263 cardiac arrhythmias noted and the prevalence rate was 17.8%. The prevalence of each cardiac arrhythmia was calculated in terms of rate per thousand. The prevalence of each arrhythmia stratified by age and sex were shown in Table 2 and 3.

Common arrhythmias found in this study were as followed: (Figure 1)

1. Sinus bradycardia was the most common arrhythmia found in this study. The prevalence rate was 108.6/1,000. The prevalence was not different between age groups but the prevalence rate in male was nearly double the prevalence rate found in female (142.9/1,000 vs. 82.9/1,000, $p < 0.005$).

2. The prevalence of 1^0 AVB was 15.6/1,000. The prevalence rate was significantly more common in male than in female (27/1,000 vs. 7.1/1,000, $p < 0.005$). There was a trend that the prevalence increased with increasing age especially those aged more than 40 years (23/1,000 vs. 14.3/1000, $p=0.01$). But the latter age group was so small that it could not be stated there was a true increase in incidence past the age of 40.

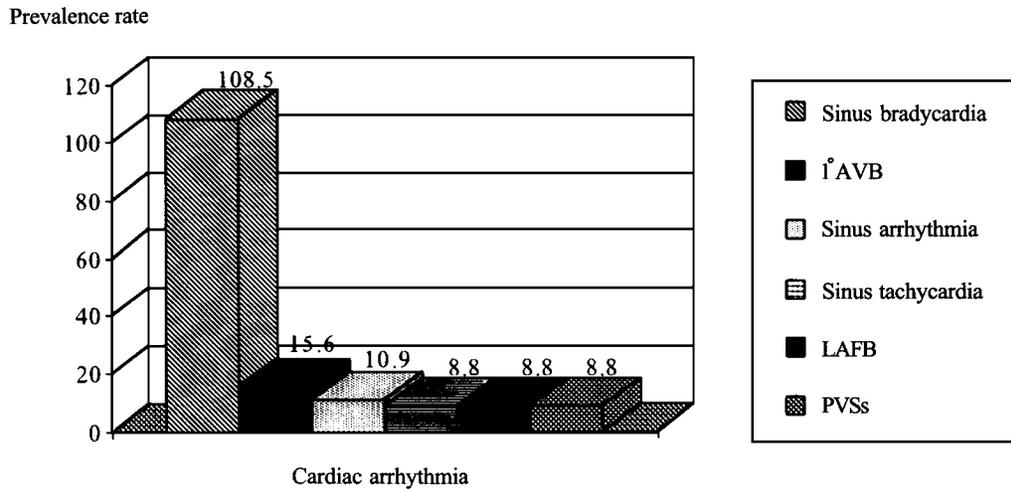3. The prevalence of sinus arrhythmia was 10.9/

Prevalence rate

Figure 1. Six common cardiac arrhythmias

Table 2. Prevalence of cardiac arrhythmia and conduction disorder-rates/1000, distributed by age and sex

Diagnosis	Age (yr)						Total	Rate per
	30-34		35-39		>40			1,000
	Male	Female	Male	Female	Male	Female		
Sinus bradycardia	53	50	24	12	13	8	160	108.6
Sinus tachycardia	1	6	1	4	1	0	13	8.8
Sinus arrhythmia	5	4	2	2	3	0	16	10.9
Junctional rhythm	0	1	0	0	0	0	1	0.7
Low atrial rhythm	0	0	0	1	0	0	1	0.7
AF	0	0	0	0	1	0	1	0.7
PAC	1	3	0	0	0	0	4	2.7
PVC	2	4	0	5	2	0	13	8.8
ICRBBB	0	0	0	0	0	1	1	0.7
CRBBB	1	1	0	0	1	0	3	2
LAFB	1	6	0	0	3	3	13	8.8
LPFB	0	1	0	0	1	0	2	1.4
1^0AVB	11	4	2	1	4	1	23	15.6
2^0 AVB type I	1	0	0	0	0	0	1	0.7
AV dissociation	0	1	0	0	0	0	1	0.7
Short PR	2	3	0	1	0	1	7	4.7
WPW	1	1	0	0	1	0	3	2

1,000. The prevalence in male was double of the rate in female (15.9/1,000 vs. 7.1/1,000, p= 0.11).

4. The prevalence of sinus tachycardia was 8.8/1,000. The prevalence rate was more common in female than in male with the rate double in female (11.8/1,000 vs. 4.8/1,000, p=0.16). It was more common in young population, the prevalence rate in population aged younger than 40 years compared to those older than 40 years were 9.5/1,000 vs. 4.6/1,000, $p < 0.005$. But the number of subjects aged more than 40 years was so small as to make prevalence rate unreliable.

5. The prevalence of left anterior fascicular block LAFB was 8.8/1,000 while the prevalence of LPFB was 1.4/1,000. LAFB was more common in

female than in male with the prevalence rate was nearly double in female, 10.7/1,000 vs. 6.3/1,000, p= 0.37, while the rate of LPFB was not different between sex.

6. The prevalence of premature ventricular contraction (PVCs) was 8.8/1,000. The prevalence in female was almost double the rate found in male, 10.7/1,000 vs. 6.3/1,000, p=0.5, while the rate of premature atrial contraction (PACs) was 2.7/1,000.

Other less common arrhythmias included: Wolff-Parkinson-White (WPW) pattern (2/1,000), while short PR interval without delta wave were found in 4.7/1,000. AF were detected in one male with the prevalence rate was 0.7/1,000. The prevalence rates of junctional rhythm, low atrial rhythm, CRBBB, ICRBBB, 2^0 AVB (type I) and AV dissociation were

Table 3. Prevalence rate of cardiac arrhythmia and conduction disorder in male and female

Diagnosis	Male (n=630)		Female (n=844)		Total	p value
	N	Rate/1,000	N	Rate/1,000	(Rate/1,000)	
Sinus bradycardia	90	142.9	70	82.9	167 (108)	<0.005
Sinus tachycardia	3	4.8	10	11.8	18 (11.7)	0.16
Sinus arrhythmia	10	15.9	6	7.1	20 (13)	0.11
Junctional rhythm	0	0	1	1.2	1 (0.7)	-
Low atrial rhythm	0	0	1	1.2	1 (0.7)	-
AF	1	1.6	0	0	2 (1.3)	-
PAC	1	1.6	3	3.6	4 (2.6)	0.5
PVC	4	6.3	9	10.7	14 (9.1)	0.5
ICRBBB	0	0	1	1.2	1 (0.7)	-
CRBBB	2	3.2	1	1.2	3 (2)	0.4
LAFB	4	6.3	9	10.7	15 (9.7)	0.37
LPFB	1	1.6	1	1.2	2 (1.3)	0.9
1^0 AVB	17	27	6	7.1	23 (15)	<0.005
2^0 AVB type I	1	1.6	0	0	2 (1.3)	-
AV dissociation	0	0	1	1.2	1 (0.7)	-
Short PR	2	3.2	5	5.9	7 (4.5)	0.45
WPW	2	3.2	1	1.2	3 (2)	0.4

0.7/1,000. 0.7/1,000, 2/1,000, 0.7/1,000, 0.7/1,000 and 0.7/1,000 respectively.

Discussion

Arrhythmia of sinus node

The most common arrhythmia that we found in this study was sinus bradycardia, the prevalence rate was 108.6/1,000 which was more common in male than in female. The prevalence rate in male was nearly twice the rate in female. Conversely we found sinus tachycardia in 8.8/1,000 which was more common in female and the rate was double when compared to the rate in male. A clear finding is that female have a mean heart rate between 5 and 10 beats/min higher than male[7]. This may be the explanation to the finding of sinus bradycardia that was more common in male and sinus tachycardia more common in female. Lok NS et al. reported the prevalence of palpitations and cardiac arrhythmia in 1,454 ambulatory elderly people (age range 60-94 years) and found that sinus bradycardia were the most common findings with the prevalence rate of 98/1,000[20] which was comparable to our findings despite the difference in the population study. We found no difference in the prevalence rate among different age groups.

The prevalence rate of sinus arrhythmia was rather high in this report when compared to the study of Kiatchoosakun et al. from Khon Kaen University[4] (10.9/1,000 vs. 2.67/1,000) because we have the higher proportion of younger populations in this report. This arrhythmia was commonly occurred in the young and decreased with age.

Ventricular premature contractions and atrial

premature contractions

PVCs can occur in association with a variety of stimuli and medical conditions such as anxiety states, excessive use of alcohol, caffeine or tobacco. These factors could cause a variation in rates of PVCs among different studies. Hiss et al.[8] reported that the prevalence of PVCs among 122,043 healthy male subjects (most of them were < 50 years of age) was 7.8/1,000, which was comparable to our report may be due to the same population of the young age group. The prevalence of PVCs from the report of Kiatchoosakun et al.[4] in Thai community was 12.1/1,000 that was higher than this report and may be due to the higher proportion the older subjects. Lok NS et al found that the prevalence among older population was 11/1,000[20]. Kostis JB et al.[9] also found that the prevalence of PVCs recorded at baseline with 12 leads ECG of 4,674 subjects with isolated systolic hypertension was 56/1,000 and was increased with age.

There was an unexpected predominantly high PVCs rate in female in our report. The rate in female was nearly double the rate in male. This result was the same from the previous study from Khon Kaen University by Kiatchosakun et al.[4] Nevertheless there are some studies, both in Thai and other populations, which showed the insignificant higher rate in female[3,10]. This may suggested that women tend to have more PVCs than men. But from SHEP study by Kostis JB et al.[9] founded that PVCs were associated with male sex.

The importance of premature ventricular complexes varies depending on the clinical setting. In the absence of underlying heart disease, the presence of

premature ventricular complexes usually has no impact on longevity or limitation of activity[11].

PACs were found in the rate lower than PVCs. The rate from this report was 2.7/1,000 that was lower from the report of Kiatchoosakun et al.[4] (4.0/ 1,000). Premature atrial complexes can occur in a variety of situations, e.g. during infection, inflammation, or myocardial ischemia, or they can be provoked by a variety of medications, by tension states, or by tobacco, alcohol, or caffeine. Lok NS et al.[20] reported the prevalence of PACs in older population 23/1,000 that was higher than the prevalence reported in Thais.

Premature complexes are among the most common causes of an irregular pulse. They can originate from any area in the heart most frequently from the ventricles, less often from the atria and from the AV junctional area, and rarely from the sinus node. Although premature complexes arise commonly in normal hearts, they are more often associated with structural heart disease and increase in frequency with age. The prevalence of premature contractions, including atrial and ventricle, was highly dependent on the technique and criteria that was used to evaluate. In this study, examined electrocardiograms provided only a limited time frame for evaluation and better evaluation of the prevalence of premature contractions can be obtained by 24 hour ambulatory ECG monitoring. In our study, premature beats were recognized when one isolated or more ectopics occurred on 12 leads ECG, which was contradictory to that suggested in the Minnesota code where the coded premature beats must occur in as many as 10% or more

of the recorded complexes[12]. Therefore, the more sensitive criteria used in this report, which allowed us to detect more isolated PVCs, may be the reason for having higher rate of PVCs.

Atrial fibrillation

Atrial fibrillation is a common arrhythmia, the prevalence is known to increase in the elderly. The report from the National Heart Lung and Blood Institute working group on atrial fibrillation, found in 1 percent in persons older than 60 years to more than 5% in subjects over 69 years old[13]. Feinberg WM et al. reported the prevalence of atrial fibrillation was 2.3% in people older than 40 years and 5.9% in those older than 65 years. Approximately 70% of individuals with atrial fibrillation were between 65 and 85 years of age[19]. The overall chance of atrial fibrillation developing over 2 decades in subjects more than 30 years old, according to Framingham data, was 2%[14]. Only one subject with AF was detected in this study, resulting in the prevalence of 0.7/1,000. The lower prevalence in this report was probably due to the population in our study were younger. The prevalence rate of AF that reported by Kiatchoosakun et al.[4] was 3.6/1,000 in Thai population which was lower than the rate reported from other studies. Although the prevalence of AF in male was not significantly higher than in female in the Framingham study[15] and male had a significantly higher rate of AF than female in the aging population[16] but report by Feinberg WM et al. found that after age 75 years, about 60% of people with atrial fibrillation were female[19]. The difference between sexes was not shown in our study which may be due to the low prevalence in this report.

Wolff-Parkinson-White syndrome

The reported incidence of preexcitation syn-drome depended on the population studied, varying from 0.1 to 3.0 per thousand in apparently healthy subjects, with an average of about 1.5 per thousand. The incidence of the electrocardiographic pattern of WPW conduction in 22,500 healthy aviation personnel was 0.25 per cent with a prevalence of documented tachyarrhythmias of 1.8%. The prevalence is higher in males and decreased with age, apparently due to loss of preexcitation[18]. The prevalence rate in our report was 2/1,000 which was comparable to other studies.

Atrioventricular block

An interpretation of 1°AVB was made in all the records that had a PR interval greater than 0.20 second. There were 23 subjects with this findings and the prevelence rate was 15.6/1,000. The prevalence rate was significantly more common in male than in female (27/1,000 vs. 7.1/1,000, $p<0.005$) and was increased with increasing aged especially those aged more than 40 years (23/1,000 vs. 14.3/1,000, $p=0.01$). But the latter aged group was so small that it could not be stated there was a true increase in incidence past the age of 40. The prevalence rate in our study was higher than the rate that reported by Kiatchoosakun et al.[4] (15.6/1,000 vs. 2.4/1,000). First degree AVB in subjects without evidence of heart disease may be a physiologic mechanism as an individual variability of refractory period at the AV junction.

Advanced AVB and complete heart block were rare finding in our study. There was one subjects with second degree atrioventricular block type I and the prevalence rate was 0.7/1,000. It should be emphasized that second degree AV block can occur in normal healthy subjects as a normal phenomenon in well-trained athletes, probably related to an increase in resting vagal tone.

Complete right and left bundle-branch block

The prevalence rate of CRBBB in this report was rather low when compared to the rate report by Kiatchoosakun et al.[4], 2/1,000 vs. 7/1,000. Report from Framingham study[17] found the prevalence rate of CRBBB of 4-5/1,000. CRBBB may occur in the absence of underlying cardiac disease despite the fact that its occurrence may also be induced in individuals with organic heart disease.

We did not find CLBBB in our study, the rate reported from Kiatchoosakun et al.[4] was 0.1/1,000. Report from other studies, for CRBBB, men have a higher prevalence than women at all ages, whereas the reverse was true for CLBBB. The reason for this was not entirely clear[7].

In contrast to the low prevalence of CRBBB and CLBBB, we found the high prevalence of LAFB that was 8.8/1,000.

Conclusions

This is a report of the prevalence of cardiac arrhythmias in 1,474 apparently healthy subjects aged 30 years and over recorded by using the resting 12 lead ECG. Of this group 263 subjects had cardiac arrhythmia with the prevalence rate of 17.8%. The prevalence in our study may be lower than the true prevalence because we used the only single 12 lead ECG to detect cardiac arrhythmia during a limited time frame. With the 24 hour ambulatory ECG monitoring, the higher

prevalence of cardiac arrhythmia can be detected.

Limitation

The subjects in this study may not represent for the general population in Thais because we studied in a selected population of relatively young people.

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