The Wolff-Parkinson-White Syndrome as an Aviation Risk

By Raphael F. Smith, M.D.

In 1930, Wolff, Parkinson, and White described a syndrome characterized by an abnormal and distinctive type of electrocardiogram and an associated tendency for sudden attacks of supraventricular arrhythmias. There has been controversy regarding the priority of the description of the electrocardiographic pattern, and widely differing theories of the pathogenesis of the syndrome have been proposed. Regardless of these uncertainties, the Wolff-Parkinson-White (W-P-W) syndrome is a definite clinical entity and occurs regularly in medical surveys of large populations. Although the alteration in excitation of the ventricular musculature that occurs in the W-P-W anomaly has not been shown to cause a significant hemodynamic effect of itself, the cardiac arrhythmias associated with the syndrome produce varying degrees of morbidity. It is also reported that the mortality rate of patients with this syndrome is increased when compared to the population at large.

It is the purpose of this paper to discuss the prevalence of the W-P-W electrocardiographic anomaly, the prevalence and incidence of the complete syndrome, the mortality rate of patients with the syndrome, and the morbidity produced by the cardiac arrhythmias. These statistical data are used in the formulation of a policy relative to the disposition of aviators and aviation candidates who are found to have the W-P-W anomaly and those who are asymptomatic with the complete syndrome. It is recognized that for the average practitioner the W-P-W syndrome is a rare entity, and, in terms of the number of patients involved, is perhaps unimportant. For the physician who deals with population studies or actuarial statistics, however, or who is concerned with the suitability of men for certain hazardous occupations, the prognosis of the syndrome assumes a greater importance.

Material and Methods

Four surveys of normal people are used in this study. Because of similarities in selection, background, age, and sex, the normal aviation personnel are frequently considered as one group. Although the differences are much greater between the two groups of normal, nonaviator members, the two groups are combined for purposes of comparison and discussion. The cardiology clinic of the U.S. Naval School of Aviation Medicine is the source of patients, but because they were referred for cardiac evaluation and treatment, they are not included with the normal groups.

When an individual was found to have the W-P-W anomaly on a routine aviation physical examination, he was referred for an evaluation, which included a careful history and physical examination; electrocardiograms at rest and after exercise; chest x-ray; serum cholesterol; protein-bound iodine; lipoprotein ultra-centrifugation; and any ancillary tests that were indicated. Two individuals in remote duty stations were not seen in this clinic but were evaluated by their squadron flight surgeons and the electrocardiograms were forwarded to this department. For follow-up information contact was made in some manner with every living member of the group. An attempt was made to recall each member of the group for repeat evaluation, and those who could not appear in person were contacted via telephone, personal letter, or through their flight surgeons. In general the cooperation was gratifying.

Normal Aviator Personnel

The primary study group consists of 33,700 individuals who were directed to have electrocardiograms by the Naval Bureau of Medicine and Surgery Instruction 6120.15, which became effective at rest.
September 1, 1960. By this instruction all entering candidates for aviation training are directed to have an electrocardiogram on their initial aviation physical examination and all aviators over the age of 45 are to have annual electrocardiograms. All designated aviators were directed to have a baseline electrocardiogram available in their health record during the ensuing 12 months. A copy of each electrocardiogram is filed in the cardiology branch of the U. S. Naval School of Aviation Medicine.

The second group of normal aviators are the 1,056 men who have been studied since 1940. This study has been termed “The Thousand Aviator Study,” and repeat cardiac evaluations have been carried out on the surviving members in 1952, 1958, and 1963. The original group was composed of 964 aviation cadets and 92 flight instructors; their mean age was 23.6 years and the age range was 20 to 30 years.

Normal Nonaviator Personnel

In 1949 to 1951, a cardiac survey was done in the Pensacola school system. Of the total enrollment of 2,057 children in grades 4 through 12 in three selected schools, 2,600 subjects were examined. Their ages ranged from 9 to 23 years, with the median age at 14.7 years.

In 1956, a survey was conducted among the civil service workers of the Pensacola Naval Air Station. The group examined was made up of 1,406 individuals who ranged in age from 18 to 80 years, with the median age at 40 years.

Cardiac Clinic Patients

During the past 23 years both military and civilian personnel have been referred to the cardiology clinic of the School of Aviation Medicine for evaluation. From this group of approximately 4,500 patients, 13 were found to have the W-P-W pattern on their electrocardiograms. Five of the 13 patients were aviators. Observations on these patients are included in the discussion of mortality and morbidity, but they are not included in the calculation of incidence or prevalence rates.

Prevalence of the W-P-W Electrocardiographic Anomaly

The prevalence ratio is determined by the number of subjects in the population studied who had the W-P-W anomaly on their initial electrocardiograms. In the primary study group of 33,700 normal aviators and aviation candidates, 31 had electrocardiograms with the W-P-W pattern. In the longitudinal study of 1,056 aviators, two subjects were found to have the W-P-W anomaly. Thus in the total group of 34,756 aviators, 33 subjects, or 0.95 per 1,000, had the W-P-W conduction anomaly.

In the nonaviator group, two electrocardiograms from the 2,600 children in the Pensacola school survey revealed the W-P-W pattern. This pattern was discovered in two records of the 1,406 Naval Air Station civil service workers. Thus in 4,006 subjects in the normal, nonaviator group the prevalence of the W-P-W pattern is 1.0 per 1,000.

Prevalence rates in similar studies are shown in table 1.

Statistics reported from series of electrocardiograms on hospital patients have shown W-P-W prevalence rates that range from 0.16 per 1,000 to 2.4 per 1,000. Although these prevalence rates are of the same order of magnitude as in our study, the population segments are not comparable, since they contain a higher proportion of ill patients and patients referred because of paroxysmal tachycardia. Also there are perhaps minor differences in diagnostic criteria among clinics.

The W-P-W pattern is occasionally intermittent, so that one would expect the number of tracings showing the W-P-W abnormality to increase as electrocardiograms are repeated on the group. It therefore becomes difficult to de-

| Table 1 |
| Prevalence of the W-P-W Anomaly in Comparable Surveys |
| Study | Population | Number with W-P-W | Rate per 1,000 |
| Sears and Manning | 15,000 RCAF aircrew members | 46 | 3.1 |
| Hiss and Lamb | 122,043 USAF aviation personnel | 187 | 1.5 |
| Dawber | Single-lead electrocardiograms, 10,547 | 1 | 0.1 |
| Present study | 34,756 aviators | 33 | 0.95 |
| Present study | 4,006 normal nonaviator subjects | 4 | 1.0 |

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fine the incidence of new cases of the W-P-W anomaly and to attempt to classify cases as congenital or acquired.

Coexisting Paroxysmal Tachycardia

The occurrence of paroxysmal tachycardia is of major concern to the physician in the field of aviation medicine and is measured by two statistical parameters, prevalence and incidence. The prevalence rate is dependent upon the number of subjects with the W-P-W anomaly who have experienced paroxysmal tachycardia at some time before their initial evaluation. The incidence rate is the number of subjects with the W-P-W anomaly in whom paroxysmal tachycardia developed during the period of observation.

Prevalence of Tachycardia

In the primary study group of 33,700 aviators and aviation candidates, 31 had the W-P-W anomaly. Of these 31 men, five described symptoms of paroxysmal tachycardia that were experienced prior to their first evaluation in our clinic. Both of the subjects in the 1,056 aviator longitudinal study were asymptomatic at the time of their initial examination. It must be noted that paroxysmal tachycardia is classified as a disqualifying defect in the Manual of the Medical Department. It is suspected that the aviator’s fear of disqualification constitutes an important form of bias because of secondary economic and career effects. An attempt was made to circumvent the tendency to withhold information by designating the data obtained from aviators on this study as privileged information and thus not including it in their official health record.

In the total group of 4,006 normal, nonaviator personnel, four subjects had tracings diagnosed as showing the W-P-W pattern, and

<table>
<thead>
<tr>
<th>Study</th>
<th>Population</th>
<th>Number with W-P-W</th>
<th>Number with tachycardia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sears and Manning 7</td>
<td>15,000 RCAF aircrew members</td>
<td>46</td>
<td>2</td>
</tr>
<tr>
<td>Averill, Fosmoe, and Lamb 15</td>
<td>67,375 USAF aviation personnel</td>
<td>187</td>
<td>(67 evaluated) 8</td>
</tr>
</tbody>
</table>

Table 2

W-P-W Anomaly and Coexisting Tachycardia in Comparable Populations

three of these people described symptoms of paroxysmal tachycardia when they were evaluated for the first time. Two of the symptomatic subjects were in the Pensacola school survey and one subject was in the Naval Air Station civil service survey.

The occurrence of tachycardia in comparable surveys of normal people is shown in Table 2.

The occurrence of paroxysmal tachycardia is much higher in series of hospital and clinic patients with the W-P-W anomaly.10–15, 16, 17 Hospital statistics pertaining to this subject are misleading because many of the patients sought medical attention because of the symptoms produced by paroxysmal tachycardia, and the W-P-W pattern was then found. In our clinic group of 13 patients with the W-P-W anomaly, 11 were symptomatic. The prevalence of paroxysmal tachycardia is obviously very high because they were referred to the clinic with tachycardia.

Incidence of Tachycardia

The number of patients with the W-P-W anomaly in whom tachycardia develops during the period of observation is a very pertinent statistic because, in the case of the aviator, it is an index of the occurrence of paroxysmal tachycardia while he is in an active flying status.

Unfortunately, the number of patients in the primary study group with the W-P-W anomaly is too small and the period of observation too short to arrive at an incidence rate with a high degree of confidence. The 26 initially asymptomatic patients with the W-P-W anomaly have been followed for 44 patient-years, and paroxysmal tachycardia has not developed in any patient during this period. The single surviving subject with the W-P-W pattern in the

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1,056 aviator longitudinal study has been without symptoms for 23 years; the other subject was killed in an aircraft accident after 5 apparently symptom-free years. Therefore, for the 28 patients in the aviator groups who were initially free from symptoms, there have been 72 patient-years of observation, and the incidence of paroxysmal tachycardia is zero.

In the normal, nonaviator group there are four patients with the W-P-W pattern. Three of these patients were symptomatic with paroxysmal tachycardia at the beginning of the study, and paroxysmal tachycardia has developed in one patient during the period of observation. In this patient the W-P-W anomaly was detected on a routine electrocardiogram during the Naval Air Station service survey and 2 years later, at age 45, the patient experienced his first attack of paroxysmal tachycardia. Two of his attacks have been severe enough to require hospitalization and quinidine therapy.

In the clinic group paroxysmal tachycardia developed in one patient during the study period. This was a 42-year-old aviator who was referred to the cardiology branch because of hypertension. He was subsequently removed from flight duty because of this abnormality, and the W-P-W pattern was an incidental finding. Two years later, at age 44, he experienced his first attack of paroxysmal tachycardia. He is not included in the primary study group because he was referred to the clinic for a specific cardiac finding and thus is considered not to be a normal subject.

Mortality Associated with the W-P-W Electrocardiographic Anomaly and the W-P-W Syndrome

In the entire group of patients under study there have been no deaths directly attributable to the W-P-W syndrome. In the total aviator group (including clinic patients) we have experience with 128 patient-years of exposure. In the total nonaviator group (also including clinic patients) we have 112 patient-years of follow-up. In the primary study group of 31 W-P-W patients, one was killed instantly in an automobile accident. There was nothing to suggest that there was physical incapacitation prior to the accident. One man (from the 1,056 aviator longitudinal study) with the W-P-W electrocardiographic pattern was killed in a mid-air collision. One aviator, a clinic patient with mild palpitation, was killed when he ditched at sea because of a broken fuel line. His flight instructor was in communication with the patient immediately before impact, and there was no mention of cardiac symptoms.

Insurance underwriters are of the opinion that patients with the W-P-W anomaly and syndrome have an increased mortality rate as compared to the general population. In preparing our report, the medical directors of 12 insurance companies were questioned regarding their company's policy toward applicants with the W-P-W anomaly and W-P-W syndrome. Their replies can be summarized as follows:

1. There are no insurance statistics that reliably document the long-term prognosis of the W-P-W syndrome. The Actua Life Insurance Company has a group of 49 people with the W-P-W pattern that has been under observation for a total of 308 patient-years. Two deaths have occurred. As yet, the mortality rate is not significantly increased in this group as compared to the population at large.

2. At the present time, the life-table mortality rate is considered to be increased 25 to 30 per cent for people under the age of 35 with the W-P-W anomaly without paroxysmal tachycardia. For people over 35, the increase in mortality is of the order of 100 per cent. If paroxysmal tachycardia is coexistent, the mortality rate is increased from 60 to 300 per cent, depending on the number, duration, and character of the attacks of tachycardia.

Morbidity Associated with the Tachycardia of the W-P-W Syndrome

In our total group of patients with the W-P-W syndrome the symptoms have ranged from a mild fluttering sensation in the chest during an attack to severe cardiac insufficiency. It is important to note that the severity of an attack cannot be predicted from the pattern of previous attacks. Several of the subjects have experienced both mild and severe epi-
### Data Concerning the Symptomatic Group of Patients

<table>
<thead>
<tr>
<th>Patient</th>
<th>Present status</th>
<th>Age at onset of symptoms</th>
<th>Method of detection</th>
<th>Frequency of attacks</th>
<th>Symptoms during paroxysmal tachycardia</th>
<th>Family history</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.L.</td>
<td>USCG aviator</td>
<td>8</td>
<td>Routine entering electrocardiogram</td>
<td>Few/year</td>
<td>Palpitation</td>
<td>Mother has palpitation</td>
</tr>
<tr>
<td>C.O.</td>
<td>Former aviation officer candidate</td>
<td>14</td>
<td>Routine entering electrocardiogram</td>
<td>Few/year</td>
<td>Palpitation</td>
<td>None</td>
</tr>
<tr>
<td>J.D.</td>
<td>Former naval aviation cadet</td>
<td>17</td>
<td>Routine entering electrocardiogram</td>
<td>Few/year</td>
<td>Fluttering in chest, mild lightheadedness</td>
<td>Mother has palpitation</td>
</tr>
<tr>
<td>G.S.</td>
<td>Naval aviator</td>
<td>23</td>
<td>Routine annual physical examination</td>
<td>Total of 2 attacks</td>
<td>Palpitation, anorexia, lethargy, Attacks lasted about 12 hours</td>
<td>None</td>
</tr>
<tr>
<td>G.C.</td>
<td>Former marine aviation cadet</td>
<td>15</td>
<td>Routine entering electrocardiogram</td>
<td>Total of 2 attacks</td>
<td>Palpitation, dyspnea</td>
<td>None</td>
</tr>
<tr>
<td>J.D.</td>
<td>Civilian housewife</td>
<td>10</td>
<td>Routine electrocardiogram, Pensacola school survey</td>
<td>Many/year</td>
<td>Palpitation, faintness but not loss of consciousness</td>
<td>Mother has palpitation</td>
</tr>
<tr>
<td>D.M.</td>
<td>Civilian</td>
<td>16</td>
<td>Routine electrocardiogram, Pensacola school survey</td>
<td>Many/year</td>
<td>Palpitation, weakness, no syncope</td>
<td>Mother has paroxysmal atrial tachycardia</td>
</tr>
<tr>
<td>H.B.</td>
<td>Civilian</td>
<td>28</td>
<td>Naval Air Station civil</td>
<td>5/year</td>
<td>Visual changes, faintness, palpitation</td>
<td>Two brothers died sudden deaths</td>
</tr>
<tr>
<td>W.H.</td>
<td>Civilian</td>
<td>45</td>
<td>Naval Air Station civil service cardiac survey</td>
<td>1/year</td>
<td>Visual changes, dizziness, marked diaphoresis, palpitation</td>
<td>None</td>
</tr>
<tr>
<td>E.C.</td>
<td>Former aviator active duty USN</td>
<td>44</td>
<td>Referred for evaluation of hypertension</td>
<td>Single attack</td>
<td>Tightness in epigastrium, palpitation</td>
<td>Daughter has paroxysmal atrial tachycardia</td>
</tr>
<tr>
<td>E.Q.</td>
<td>Retired petty officer</td>
<td>17</td>
<td>Referred for evaluation of rheumatic fever</td>
<td>Many/year</td>
<td>Fluttering in chest, numbness of arms</td>
<td>None</td>
</tr>
<tr>
<td>T.A.</td>
<td>Retired sergeant USAF</td>
<td>22</td>
<td>Referred because of palpitation, dyspnea (rheumatic heart disease)</td>
<td>1/week</td>
<td>Palpitation</td>
<td>None</td>
</tr>
<tr>
<td>A.P.</td>
<td>Retired petty officer</td>
<td>30</td>
<td>Retirement physical examination</td>
<td>4/year</td>
<td>Palpitation</td>
<td>None</td>
</tr>
<tr>
<td>T.P.</td>
<td>Aviator (deceased)</td>
<td>8</td>
<td>Cardiac clinic research subject</td>
<td>Only during childhood</td>
<td>Palpitation, killed in aircraft accident</td>
<td>None</td>
</tr>
<tr>
<td>J.W.</td>
<td>Retired civil service worker</td>
<td>38</td>
<td>Referred because of paroxysmal tachycardia</td>
<td>3/year</td>
<td>Palpitation, weakness, aching in arms, apprehension</td>
<td>Mother had palpitation</td>
</tr>
<tr>
<td>R.P.</td>
<td>Naval aviator</td>
<td>18</td>
<td>Routine annual physical examination</td>
<td>Total of 2</td>
<td>Palpitation for approximately 1 minute</td>
<td>None</td>
</tr>
<tr>
<td>J.K.</td>
<td>Former naval aviator</td>
<td>25</td>
<td>Hospitalized because of paroxysmal tachycardia</td>
<td>5/year</td>
<td>Apprehension, exhaustion, palpitation</td>
<td>None</td>
</tr>
<tr>
<td>D.G.</td>
<td>Retired seaman</td>
<td>24</td>
<td>Hospitalized because of syncope</td>
<td>2/year</td>
<td>Syncope, palpitation</td>
<td>None</td>
</tr>
<tr>
<td>J.G.</td>
<td>Navy dependent</td>
<td>8</td>
<td>Evaluation because of palpitation</td>
<td>15/year</td>
<td>Nausea, palpitation</td>
<td>None</td>
</tr>
<tr>
<td>M.R.</td>
<td>Retired petty officer</td>
<td>34</td>
<td>Evaluation because of palpitation</td>
<td>Few/year</td>
<td>Chest pain, dyspnea, palpitation</td>
<td>None</td>
</tr>
</tbody>
</table>
sodes. The most dramatic episode of the group occurred in a 29-year-old aviator in whom paroxysmal tachycardia developed during an evening meal. He was not particularly concerned because mild episodes had occurred previously. When it persisted, he reported to a Naval Hospital and treatment with quinidine was initiated. During the night, after receiving only 300 mg. of quinidine, his blood pressure fell to shock levels, he was placed in the Trendelenburg position, and a vasopressor was administered. At 8:00 the next morning the rhythm reverted to sinus with QRS complexes of the W-P-W type. There was prompt recovery. The patient was subsequently given a medical discharge, and he has been followed in our cardiology clinic for 12 years. He has had multiple episodes subsequent to the severe attack which occurred in 1951. Another of our clinic patients had a sudden attack of tachycardia and collapsed while crossing a street.

Table 3 contains data concerning the symptomatic group of patients, and the symptoms in order of frequency of occurrence are tabulated in table 4. It can be seen from table 1 that the tachycardia of the W-P-W syndrome has a marked tendency to be recurrent, as over 90 per cent of the patients have had more than one attack.

In the total group of symptomatic patients, the mean age at onset of symptoms is 22.2 years, and the median age 20 years. Fifteen patients experienced symptoms prior to the age of 30, and in five patients symptoms developed after the age of 30. At the time of the present analysis the mean age of the symptomatic group of patients is 35.4 years, and the median age is 36.5 years. It would appear that the majority of the subjects with the W-P-W anomaly experience symptoms at an early age.

**Discussion**

The data from this clinic indicate that the prevalence of paroxysmal tachycardia is quite high (75 per cent) in the nonaviator group and low (15 per cent) in the aviator group. The apparent statistically significant difference in prevalence can be explained partially by the selection that occurs when some symptomatic aviation candidates are eliminated prior to their reaching this aviation examining center. Also, the aviator’s tendency to withhold information is an important source of bias.

It has been the policy of this cardiology department to recommend that aviation candidates with the W-P-W anomaly be dropped from the training program because of their increased chance for paroxysmal tachycardia and subsequent disqualification. Pilots who have completed their training and have no symptoms of paroxysmal tachycardia have been allowed to continue in an active flying status. Reportedly, the USAF and the RCAF have similar policies toward aviation personnel.

It would appear from our data that the incidence of paroxysmal tachycardia in patients with only the W-P-W anomaly is quite low during the period of operational flying duty. It is true that the small number of subjects in this study with the W-P-W anomaly does not allow this assertion to be made with a high level of confidence, and there is always the possibility of significant bias being present. Nevertheless, the data contained in this report and the data published from the Royal Canadian Air Force do not support our current policy of disqualifying aviation candidates with the W-P-W anomaly who have no history of paroxysmal tachycardia.

The morbidity associated with the W-P-W syndrome is quite variable and ranges from mild palpitation to cardiac insufficiency and
shock. Over 90 per cent of our symptomatic patients have had more than one attack of tachycardia. It is thought that the unpredictability of both the onset and severity of the paroxysms of tachycardia is a feature of the W-P-W syndrome that constitutes a hazard for the aviator.

Our data are inadequate for an assessment of the increase in mortality rate that is purported to be associated with the W-P-W syndrome. Although there are reports of patients dying during an attack of paroxysmal tachycardia, no objective information has been located in the medical literature to quantitate this association. There is no evidence from our study groups that the occurrence of other forms of heart disease is more frequent in patients with the W-P-W anomaly. The presence of the W-P-W pattern can obscure electrocardiographic changes caused by concomitant diseases. Most of the patients with the W-P-W pattern on their electrocardiogram in our study had striking ST-segment depression on their tracings recorded after exercise, and occasionally after exercise W-P-W beats alternated with normal complexes. It was observed that, while the W-P-W complexes had ST-segment depression, the normal beats had no significant depression. Similar observations have been made by other authors.

Three patients were made mildly hypoxic in the low pressure chamber. After approximately 5 minutes at a simulated altitude of 18,000 feet without oxygen, ST-segment depression appeared on their electrocardiograms but promptly returned to normal after they breathed 100 per cent oxygen. One patient's tracing showed intermittent W-P-W beats while he was in the low pressure chamber, and there was no ST-segment depression in the normal complexes of the same tracing. We were unable to precipitate an episode of paroxysmal tachycardia in any of the patients studied.

Summary and Conclusions

From the observations summarized in table 5 on our groups of subjects and from similar reports in the medical literature the conclusion is reached that asymptomatic aviators and aviation candidates with the W-P-W anomaly could be allowed to continue in an unrestricted flying status but those with paroxysmal tachycardia should be permanently disqualified for duty involving the actual control of aircraft.

Our primary study group is a rigidly selected population, and the findings in this group cannot be freely applied to the general population. The conclusions from these data should, however, be applicable to other populations that are similar in composition.

References


Table 5

Summary of Findings

<table>
<thead>
<tr>
<th>Source and sample size</th>
<th>Number with W-P-W anomaly</th>
<th>Patient years</th>
<th>Prevalence W-P-W anomaly</th>
<th>Prevalence paroxysmal tachycardia</th>
<th>Incidence paroxysmal tachycardia</th>
<th>Deaths all causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Normal aviator personnel: 33,700 aviators and aviation candidates directed to have electrocardiogram</td>
<td>31</td>
<td>53</td>
<td>0.92 per 1,000</td>
<td>5</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1,056 aviators longitudinal study</td>
<td>2</td>
<td>28</td>
<td>2.0 per 1,000</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td>81</td>
<td>0.95 per 1,000</td>
<td>5</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>2. Normal nonaviator personnel: 2,600 Pensacola school children</td>
<td>2</td>
<td>29</td>
<td>0.77 per 1,000</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1,406 NAS civil service workers</td>
<td>2</td>
<td>14</td>
<td>1.4 per 1,000</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>43</td>
<td>1.0 per 1,000</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3. Cardiac clinic patients: 4,500 patients referred for cardiac evaluation</td>
<td>13</td>
<td>115</td>
<td></td>
<td>10</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
18. Ungerleider, H. E.: Personal communication.

Humility

Perfection is at a great distance from every mortal being. The experience of any individual is greatly defective, and a large proportion of what we fancy we know must be taken on trust from others of every age and country.—Preface. Collections from the Unpublished Medical Writings of the Late Caleb Hillier Parry, M.D.F.R.S. Vol. I., London, Underwoods, Fleet-Street, 1825, p. 3.

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