Silent Myocardial Infarction

EKG Survey of Mentally Ill Patients at the Hudson River State Hospital

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Since 1925, numerous articles have been written,* about the electrocardiographic findings among mentally ill patients.** Many factors responsible for changes in these findings were mentioned: emotional disorders, endocrine dyscrasias, hyperventilation, dehydration and avitaminosis, tobacco, change of body position, vago-sympathetic imbalance, anxiety, respiratory movements, etc. Some of the authors' even mentioned: "Our electrocardiographic criteria may need radical revision," barring, of course, myocardial infarction. In the Chest Clinic of the Hudson River State Hospital we have about 3,000 electrocardiograms which were taken prior to 1959. There has never been a feeling that these contained any electrocardiographic changes which differ from the general population.

There have also been articles written about the occurrences of painless myocardial infarction in mentally ill patients,* with percentages varying from less than 1 per cent to as high as 38 per cent, but again in our routine examination we have not found such a high incidence, our findings being insignificant.

To ascertain the presence of electrocardiographic changes in mentally ill patients, and also to find out how many had myocardial infarction without noticeable symptoms or complaints, an electrocardiographic survey was undertaken. Fifteen hundred patients have been studied, they were selected because they had no sign or symptom of any cardiac condition as far as the physicians in charge of their care were concerned, after at least five years of hospitalization.

Some time ago the medical staff of the Hudson River State Hospital was put on the alert to watch for patients whose behavior changed suddenly, especially those who became unusually quiet, withdrawn from the other patients or showed any tendency to remain for long periods in bed with the covers drawn up over their heads. This behavior was first noted among known tuberculosis patients and through experience we have found that such behavior often indicates either reactivation or worsening of the pulmonary tuberculosis. The same change in behavior has been noted to apply to some serious cardiac diseases. These patients were excluded from our survey.

Electrocardiograms were taken by nurses trained as EKG technicians, and to avoid human error as much as possible, the tracings were read by three physicians: Dr. Jay R. Lockwood, Senior Attending in Medicine at Vassar Brothers Hospital, Poughkeepsie, New York, Dr. Robert J. Som-

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**Over 45 articles have been reviewed, but due to a limited space, only a few will be mentioned in "references."

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mer, Senior Attending in Medicine at St. Francis Hospital, Poughkeepsie, New York, and the writer.

It is rather difficult to interpret the EKG's of mentally ill patients inasmuch as emotional factors come into play. It is a well known fact that the result of emotional stimuli to the cardiovascular system may be classified as follows: 1. "those involving cardiac rate and rhythm" (such as sinus tachycardia or bradycardia; of course when a very rapid rate is present for a long time, especially in the older group, there are temporary signs of myocardial ischemia present). 2. "those involving the vessels to localized areas, such as the skin, brain, heart or kidney" (dilatation or vasoconstriction which manifests itself by blushing, pallor, urticaria with vascular headaches, which in turn produces a rather different voltage in the EKG). 3. "those involving the circulation as a whole." (Such as a decreased peripheral resistance, visceral vasoconstriction and discharge of epinephrine from the adrenal glands. Increase of blood pressure and increase of peripheral resistance produce decreased cardiac output. It is well known that mental stress may exacerbate hypertension and its symptoms, so that the EKG also will be somewhat affected). 4. "those affecting the physical characteristics of the blood," (We found these changes to be irrelevant in our studies).

At times there has been difficulty in interpreting the so-called functional EKG abnormalities which have been reported in young people free of cardiac disease when ST changes have been observed with marked depression of the segments in extremities and chest leads.

There are numerous articles about the high ST takeoff in normal patients and it has been stressed again that such findings are really to be kept in mind when interpreting a large number of EKGs, especially in mentally ill patients. There are also reports about the T inversion in healthy people with hyperventilation.

In our group, many patients, in addition to mental illness, also have glandular disfunction and at times it is trying to interpret the importance of the low voltage of QRSST. In the absence of good reliable past history in our patients, the iso-electric ST is at times puzzling—double infarction might be manifested by such findings, but the age of such patients and their robust, healthy appearance speaks against such pathology. Often retakes clear up the puzzle.

First, it is interesting to note that there is some disagreement between the three physicians mentioned concerning the interpretations of the electrocardiographs. To eliminate as much discrepancy as possible, the three of us had separate readings and then the controversial tracings were re-evaluated in group meetings. Although we agreed in advance that certain "Standard Patterns" of myocardial infarction would be our guide, as well as other pathology (L. ventricular preponderance, coronary insufficiency, eschima, etc.), numerous retakes were done to avoid wrong interpretations. Then we re-read all the abnormalities, argued, and in the end came to final agreement.

The death rate has also been reviewed from 1952-1956 from the annual report which was published by the hospital. From a total of 2,014 patients, 1,477 died from cardiovascular disease. Unfortunately, only 170 could be autopsied and the following report is submitted:
Discrepancy between the number of deaths and the number of autopsies reported is because the New York State law requires permission from the legal next of kin to perform a post-mortem examination and many were refused.

Acute, sudden coronary thrombosis with infarction occurred in only 13 cases and the average age of deceased was 73 years. There were 14 cases of coronary occlusion, all sudden, with an average age of 69 years. From the combined group, totalling 27 cases, it was found that 75 per cent had cardiac pathology (generalized arteriosclerosis) upon admission, or after prolonged hospitalization, and the other 25 per cent fell in the age group where some arteriosclerotic heart disease findings would be expected. In other words, the autopsy reports did not reveal the presence of demonstrable myocardial degeneration, though one would expect such findings.

From this total 170 post-mortem examinations, only brief abstracts were available for study, and these were not too exact in regard to location and degree of the infarction. The slides which usually should accompany the abstract also could not be found, probably due to the system of filing, as the death cases are usually put in storage. The pathologist who performed the autopsies has been retired and we could not get information from him.

From the 1,500 EKG's taken, 203 showed abnormalities and only 25 could be called silent myocardial infarctions, since the EKG changes were definite. However, the rest of the pathological group will be studied in the future with serial EKG tracings. A complete review of the records of 25 patients shows that at no time did they have symptoms or complaints pertaining to cardiac pathology, although one would suspect some symptoms in the 59 with coronary insufficiency under normal circumstances.

The vast majority of EKG's (1,297) were normal, after minor controversies were ironed out by the reviewing group, and a review of the hospital records on these patients did not reveal anything unusual either in their physical examination by the ward physician or in their behavior. In private practice a great deal of thought and study has been directed toward determining the role of emotional factors in contributing to possible coronary disease or symptoms, and a great many articles have been written about this condition, especially in the differential diagnosis of true angina pectoris.10-37 It is remarkable that severely psychotic patients are often felt to be so immersed in their own delusions and emotional problems that they give no hint of symptoms pertaining to cardiac disorders, even including angina. Their mental condition is such that we cannot get good histories from them. They do not call the atten-
tion of nurses or doctors to themselves and it is believed that many of them have lost "the meaning of pain." We cannot use many of the drugs which have been advocated as a test, nor can we use "Master's Test" or other helpful means because the majority are rather uncooperative, or even if willing, they become confused and bewildered, thus giving poor results as far as the tests are concerned.

However, since a new hospital policy of "open door" has been instituted a remarkable change in psychotic patients has taken place—they are more contented, appear happier and less secluded, and perhaps more cooperative, but still few could really cooperate to the full extent for our studies.

Searching for a simple test which could be easily performed, we were impressed by the EKG tracings of psychiatric patients who had been on rather large and prolonged dosages of thorazine. The tracings in the majority of these cases were with perfect isoelectric lines, clear and free of doubtful variations of the P, Q, RST, and with a slow pulse rate. Furthermore, in the majority of the thorazine group the EKGS were normal, except for a few bradycardias, which were found in spite of the fact that tachycardia had previously been reported.

Assuming that the medication might be helpful in the differential diagnosis of coronary insufficiency, we used, as a test, thorazine 100 mg. tablets three times a day for three days, and then repeated the electrocardiograms. Fourteen patients were selected whose original EKG's were in the group of doubtful tracings, but judged by the consensus of opinion of the three participating doctors, were within normal limits.

We did not include in this group anyone who had an elevation of blood pressure, (except No. 3 — 180/108 — 45 years of age), and the average age was 45 years. (Two were under 20, three over 60, and the rest were scattered between the ages of 25 and 59). The results of the electrocardiograms were rather unexpected:

1. Nine cases showed no change.
2. Four showed some changes but these were not significant enough to warrant evaluating the tracing differently.
   (a) No. 9-T waves became lower in precordial leads, rate increased from 62 to 82. P2 became of much less voltage.
   (b) No. 11 — QRS in AVL became of higher voltage and T became negative.
   (c) No. 12 — Pulse slowed down from 138 to 90. ST less depressed in V4, V5 and V6.
   (d) No. 13 — T negativity in V4, V5, and V6 less pronounced.
3. One case (No. 5) after thorazine EKG showed signs of posterior wall infarction which was without the usual symptoms and was unquestionably silent, perhaps caused by the thorazine medication. On the other hand, if medication could produce a severe or even moderate hypotensive action, then we should really have much more frequent infarctions since a great number of our patients receive such drug. In fact, from normal EKG patients, 331 were on drug, 966 without it; from 203 abnormal on drug, 42 remaining; 161 no drug. On the other hand, from 59 Coronary Insufficiency cases — 13 have been on thorazine.
RESUME

From 1500 cases studied 849 men (56.6 per cent) 651 women (43.4 per cent)
Total cases abnormal 125 men (81.57 per cent) 78 women (38.43 per cent)
203
Average age of abnormal 64.13 yrs. men 64.42 yrs. women
Average yrs. hosp. of abnormal 21.274 yrs. men 19.602 yrs. women
20.618 yrs.

Blood pressure of abnormal

- High
  - Per cent
  - Norm.
  - Low
  - Unknown

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infarct (incl. 3 qes.)</td>
<td>25</td>
<td>0.016 or 1.6</td>
</tr>
<tr>
<td>Rt. BBB</td>
<td>18</td>
<td>0.012 or 1.2</td>
</tr>
<tr>
<td>Lt. BBB</td>
<td>12</td>
<td>0.008 or .8</td>
</tr>
<tr>
<td>Coronary Insufficiency</td>
<td>59</td>
<td>0.038 or 3.8</td>
</tr>
<tr>
<td>Left vent. prepond.</td>
<td>28</td>
<td>0.017 or 1.7</td>
</tr>
<tr>
<td>Non-specific</td>
<td>3</td>
<td>0.002 or .2</td>
</tr>
<tr>
<td>Myocardial ischemia</td>
<td>1</td>
<td>0.0006 or .06</td>
</tr>
<tr>
<td>Auricular Fibrillation</td>
<td>4</td>
<td>0.0026 or .26</td>
</tr>
<tr>
<td>Rt. vent. hyper.</td>
<td>3</td>
<td>0.002 or .2</td>
</tr>
<tr>
<td>Rheumatic heart</td>
<td>2</td>
<td>0.0013 or .13</td>
</tr>
<tr>
<td>Paroxysmal supraventric tachy</td>
<td>1</td>
<td>0.0006 or .06</td>
</tr>
<tr>
<td>AV Block</td>
<td>33</td>
<td>0.022 or 2.2</td>
</tr>
<tr>
<td>Left vent. strain</td>
<td>12</td>
<td>0.008 or .8</td>
</tr>
<tr>
<td>Congenital defect</td>
<td>1</td>
<td>0.0006 or .06</td>
</tr>
<tr>
<td>Mult. vent. extrasystoles</td>
<td>1</td>
<td>0.0006 or .06</td>
</tr>
<tr>
<td>Total Abnormal Cases</td>
<td>203</td>
<td>0.135 or 13.5</td>
</tr>
</tbody>
</table>

BREAKDOWN OF ABNORMAL BY MENTAL DIAGNOSIS

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Abnormal</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychosis with Mental Deficiency</td>
<td>9</td>
<td>.044 or 4.4</td>
</tr>
<tr>
<td>Alcoholic Psychosis</td>
<td>17</td>
<td>.082 or 8.2</td>
</tr>
<tr>
<td>Psychoses due to other Metabolic Diseases Assoc. with Organic Changes</td>
<td>1</td>
<td>.004 or .4</td>
</tr>
<tr>
<td>Paranoid with Paranoid Condition</td>
<td>1</td>
<td>.004 or .4</td>
</tr>
<tr>
<td>Involuntional Psychosis</td>
<td>12</td>
<td>.059 or 5.9</td>
</tr>
<tr>
<td>Cerebral Arteriosclerosis</td>
<td>12</td>
<td>.059 or 5.9</td>
</tr>
<tr>
<td>Sensile Psychosis</td>
<td>7</td>
<td>.034 or 3.4</td>
</tr>
<tr>
<td>Psychosis due to Trauma</td>
<td>4</td>
<td>.019 or 1.9</td>
</tr>
<tr>
<td>Psychosis-Psychopathic Personality</td>
<td>2</td>
<td>.009 or .9</td>
</tr>
<tr>
<td>Psychosis-Epidemics Encephalitis</td>
<td>1</td>
<td>.004 or .4</td>
</tr>
<tr>
<td>Psychoneurosis</td>
<td>4</td>
<td>.019 or 1.9</td>
</tr>
<tr>
<td>Manic Depressive</td>
<td>5</td>
<td>.024 or 2.4</td>
</tr>
<tr>
<td>Mixed</td>
<td>2</td>
<td>.009 or .9</td>
</tr>
<tr>
<td>Paranoid</td>
<td>1</td>
<td>.004 or .4</td>
</tr>
<tr>
<td>Manic</td>
<td>1</td>
<td>.004 or .4</td>
</tr>
<tr>
<td>Simple</td>
<td>1</td>
<td>.004 or .4</td>
</tr>
<tr>
<td>Schizophrenia — Total</td>
<td>110</td>
<td>.541 or 54.1</td>
</tr>
<tr>
<td>Hebephenic</td>
<td>26</td>
<td>.128 or 12.8</td>
</tr>
<tr>
<td>Catatonic</td>
<td>7</td>
<td>.034 or 3.4</td>
</tr>
<tr>
<td>*(Note on lobotomy group)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paranoid</td>
<td>62</td>
<td>.305 or 30.5</td>
</tr>
<tr>
<td>Mixed</td>
<td>6</td>
<td>.029 or 2.9</td>
</tr>
<tr>
<td>Simple</td>
<td>10</td>
<td>.048 or 4.8</td>
</tr>
<tr>
<td>Psychosis — Cerebral Syphilis</td>
<td>3</td>
<td>.014 or 1.4</td>
</tr>
<tr>
<td>General Paresis</td>
<td>7</td>
<td>.034 or 3.4</td>
</tr>
<tr>
<td>Epilepsy</td>
<td>1</td>
<td>.004 or .4</td>
</tr>
<tr>
<td>Undiagnosed Psychosis</td>
<td>1</td>
<td>.004 or .4</td>
</tr>
</tbody>
</table>

*From 46 post-lobotomy group studied — only one abnormal found. This was a Rt. BBB, included in with Schizophrenia totals.
*From a total of 90 morons, idiots, and imbeciles at Wassaic State School, 30 were able to be studied. In this group there was no abnormality.
*Totals in the extreme right column, under number in hosp., are based on the 1958 total census of 5,713. Of this number, there were 2,507 men, 3,206 women.
However, the previous warning that hypotensive effect might be produced by certain tranquillizing drugs and that it should not be used in either generalized arteriosclerosis or cardiovascular disease, still stands. Thorazine was abandoned as a test.

One and one half years later, 64 cases were retaken by mistake and in eight cases the EKG's were different from previous ones:

(1) No. 36 — the first was called normal, 2nd plus 1st, AV block.
(2) No. 146 — first was normal; 2nd — AV block.
(3) No. 156 — first normal; 2nd — posterior wall infarction.
(4) No. 193 — first normal; 2nd — left ventricular strain.
(5) No. 176 — first normal; 2nd — intraventricular convection disturbance.
(6) No. 201 — first normal; 2nd — ischemia due to tachycardia.
(7) No. 292 — first ischemia; 2nd — normal.
(8) No. 946 — first myocardial insufficiency; 2nd — normal.

These 64 cases bring up a very interesting question as to how to conduct a survey, how many patients should be studied and whether it is necessary to follow up the normals, and if so, for how long and at what intervals. Going through 1500 cases we found the following percentages:

From 62 — there were 0.6 per cent infarctions found.

From 100 — 1 per cent
200 — 2.5 per cent
300 — 3 per cent
400 — 1.5 per cent
800 — 1.6 per cent
1000 — 1.7 per cent
1200 — 0.7 per cent
1500 — 1.6 per cent

Judging from these figures, perhaps 800 would be sufficient for study of total hospital population — over 5000. As far as a follow-up is concerned, no definite rule can be advocated.

Beginning June 15, 1959, we hope routine electrocardiograms will be taken on admission of those patients over 40 years of age, and in the younger group also if there is any history of pre-existing cardiac disease. Thus, we shall have comparison material for future studies. We also plan to do EKG's on all patients following completion of electric shock therapy, in addition to the routine tracing which has always been taken prior to the electric shock treatments as well as all patients prior to surgery.

The "silent myocardial infarction" will require study and research in every institution housing a great number of inmates; results should be useful and interesting. Incidentally, included in our normal group were 30 cases of imbeciles and morons and we have come to the conclusion that in order to keep the coronary vessels in a healthy condition, one should perhaps be more idiotic and moronic.

SUMMARY

1. Silent myocardial infarction occurs among mentally ill patients but in our study the percentage is rather low (1.6 per cent) as compared with previous reports.
2. There is no relationship between infarction and any given psychiatric diagnosis: Infarction is not more prevalent in one psychiatric group than another.
3. Cardiac pathology, other than myocardial infarction, (13.5 per cent) exists in comparatively greater number but the majority of these diagnoses could be made only with the help of EKG.

4. Wards designated for cardiac patients should be investigated with EKG as well as wards housing diabetics.

5. It seems desirable that EKG studies be made on admission of patients over 40 years of age, on pre-surgery cases, pre and post ETC and all cases which might be suspicious for presence of cardiac disease.

6. If from 1500 cases studied, 203 new cardiac cases were found, it is safe to assume that another 743 cases could be cardiacs, but most likely free of symptoms or complaints or perhaps some are already on cardiac wards.

ACKNOWLEDGMENT: The writer is grateful to all the persons who participated in this study. To Dr. Robert C. Hunt, Director of the Hudson River State Hospital, who made it possible to continue this work which was undertaken while Dr. O. A. Kilpatrick was Director. Practically every member of the Staff, nurses, and other employees, helped in gathering data, particularly the Staff in the Tuberculosis Department who took the Electrocardiograms and tabulated many data.

RESUMEN

1. Se pueden presentar infartos silenciosos del miocardio en los enfermos mentales para nuestro estudio, el porcentaje es más bien bajo (1.6 por ciento comparado con otras comunicaciones).

2. No hay relación entre el infarto y cualquier diagnóstico psiquiátrico; el infarto no es más frecuente en uno u otro grupo.

3. La patología cardiaca además del infarto cardiaco (13.5 por ciento) existe en número comparativamente mayor, pero la mayoría de estos diagnósticos pudo hacerse sin mediante el E.C.G.

4. Los servicios para enfermos cardiacos deben ser investigados por el electrocardiograma de la misma manera que lo son para la diabetes.

5. Es de desearse que se hagan estudios electrocardiográficos de ingreso en los enfermos mayores de 40 años y en todos los casos sospechosos de enfermedad cardiaca.

6. Si en 1,500 casos estudiados, 203 nuevos cardiacos se han encontrado, es de presumirse que otros 743 casos podrían ser cardiacos pero muy probablemente sin síntomas o tal vez algunos ya están en los servicios de cardiacos.

RESUMÉ

1. L'infarctus myocardique silencieux survient chez des malades mentaux, mais dans notre étude, le pourcentage est plutôt faible (1,6% selon la comparaison avec des rapports antérieurs).

2. Il n'y a pas de rapport entre l'infarctus et un diagnostic psychiatrique donné: l'infarctus n'est pas plus prédominant dans un groupe psychiatrique que dans un autre.

3. La pathologie cardiaca, autre que l'infarctus myocardique (13,5%) existe dans un nombre de cas comparativement plus grand, mais la majorité de ces diagnostics ne pourraient être faits qu'avec l'aide de l'électrocardiogramme.

4. La menace d'une cardiopathie devrait inciter à faire un électrocardiogramme exactement comme l'on fait quand on s'occupe de diabétiques.

5. Il semble désirable que les études électrocardiographiques soient faites à l'admission des malades âgés de 40 ans et plus, pour les cas pré-chirurgicaux et pour tous ceux qui pourraient être suspects d'atteinte cardiaque.

6. Si sur 1,500 cas étudiés, 203 nouveaux cas cardiaques ont été trouvés, il est raisonnable de penser que 743 autres pourraient être cardiaques, mais qu'ils sont vraisemblablement indemnes de symptômes ou de douleurs, ou peut-être que quelques-uns et sont déjà au stade des menaces cardiaques.

ZUSAMMENFASSUNG

1. Stumme Myokardinfarkte kommen bei Geisteskranken vor, jedoch nach unserer Untersuchung in ziemlich geringer Zahl (1,6% im Vergleich zu früheren Berichten).

2. Es besteht keine Beziehung zwischen Infarktenzene und der gegebenen psychiatrischen Diagnose: Infarkte kommen in keiner bestimmten Gruppe von psychiatrischen Patienten häufiger vor als in einer anderen.

3. Pathologische kardiale Befunde, vom Myokardinfarkt abgesehen, (13,5%) kommen in vergleichsweise größerer Häufigkeit vor, aber die größere Zahl dieser Diagnose konnte nur mit Hilfe der EKG gestellt werden.

4. Für Herzkranken bestimmte Krankenstationen müssen mit EKG untersucht werden, ebenso wie Abteilungen, auf denen sich Diabetiker befinden.

5. Es dürfte sich empfehlen, EKG-Untersuchungen vorzunehmen, wenn Patienten von mehr als 40 Jahren aufgenommen werden, wenn operative Eingriffe vorgesehen sind, vor und nach ETC, und bei allen Fällen, bei denen der Verdacht besteht auf das Vorliegen von Herzerkrankungen.
6. Wenn unter 1500 untersuchten Fällen 203 neue Herzfälle entdeckt wurden, so kann man sicher annehmen, dass noch weitere 743 Herzkranké darunter sind, jedoch höchstwahrscheinlich ohne Symptome oder Beschwerden; vielleicht befinden sich aber auch einige schon auf einer Herzstation.

REFERENCES

11 Cardiovascular Rehabilitation, Edited by P. D. White, Blakiston Division (McGraw-Hill Book Co.) 1957.