THE ELECTROCARDIOGRAM OF THE MONTH

The authors would be pleased to receive comment and controversy from readers in relation to explanations offered.

During the examination of a 33 year old man who had applied for a position as an airplane pilot an electrocardiogram was encountered that showed small inverted T waves in the left precordial leads. There was no history and no other signs that suggested heart disease. In an attempt to investigate the electrocardiogram more fully records were made as shown in figure 1.

It is to be noted that the electrocardiogram made under basal conditions is entirely within normal limits. When hyperventilation and exercise are performed by the fasting patient the T waves in Leads II, V5 and V6 became inverted but returned to their basal form within a short period of time (see "control before
breakfast"). Not immediately following a meal, but fifteen minutes later there are T wave changes in Leads II, V5 and V6 that remain constant for more than forty minutes. Hyperventilation and exercise produce more marked effects now than they did while fasting. Additionally, three minutes of vigorous bicycle exercise results in inversion of the T wave in Lead I. Ten minutes later this effect is gone, the tracing having largely returned to the form that resulted from food alone. Both in the limb leads and precordial leads the T waves could be inverted by having the patient sit up.

There was no history suggesting a cardiac lesion and the physical examination and X-ray studies revealed no evidence of heart disease of any kind.

The electrocardiographic study shows, in general, T wave changes that we found to be common among young healthy adults 18-23 years of age: Lowering and inversion of T waves in Leads with large R waves result from increasing rate, exercise, and other non-pathologic conditions that diminish the magnitude of the ventricular gradient. The inversion of the T wave in Lead I that occurs in this case will attract much attention. There is sound basis for concluding that the T wave may occasionally be inverted in Lead I in the absence of disease especially in the circumstances under which it is encountered here. However, the incidence of this finding among normals under ordinary circumstances is so small that it is bound to be held suspect under any circumstances.

We believe that the inversion of the T waves in this case, occurring under the circumstances indicated, are probably not produced by disease. We base our conclusion upon the confidence that we have in the physiologic approach to electrocardiographic interpretation. In order to record an opinion that an inverted T wave in Lead I may be normal we recognize that it is necessary to overcome a rather deep-rooted prejudice that grows in the soil of the statistical approach to the limitations of normal variations. Since the statistical approach has been so confusing in relation to so many electrocardiographic problems it is perhaps time to uproot some of the prejudices that have grown out of it.

Unfortunately, as so often occurs, we can not be absolutely certain that our conclusion in this case is correct, for an antero-lateral zone of epicardial ischemia can also diminish the magnitude of the ventricular gradient and thus cause similar inversion of the T waves. However, when ischemia is responsible for small inverted T waves, exercise will generally cause the T waves to become upright again. On the other hand, if the diseased area of myocardium is represented by scar tissue, with little or no surrounding ischemic zone, the electrocardiogram may well behave as it has in this case. In the latter case QRS changes that reveal the presence of such scarring may not be discernible.

MANUEL GARDBERG, M.D. and IRVING L. ROSEN, M.D.*
New Orleans, Louisiana

*From the Cardiac Research Laboratory, Touro Infirmary and the Department of Medicine, Louisiana State University Medical School.