Correspondence

very poor fit

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then

The single cosinor technique

Murnaghan et al in their study of blood pressure in

pregnancy. 2 The single cosinor technique failed to
give sufficient resolution to describe other than gross
features of the blood pressure patterns. Walsh and
Goldberg also found that significant components were
present at higher frequencies. 3 Detailed studies by
Sayers 4 indicate the presence of several concurrent
patterns, posing severe problems in any detailed
statistical analysis across patients. More recently, the
same group has suggested a set of procedures for pat-
tern analysis of these records, relying more on measure-
ments from each record than on a priori models. 5
These procedures are at present being applied to
blood pressure data from a variety of sources.

In active untreated subjects the timing of the
acrophase must be heavily dependent on the time of
waking since this is the event which has the greatest
effect on blood pressure. This would tend to place the
acrophase at approximately 14 hours before waking—
that is, at 1800 or so, and this has been the
finding of several workers. 3 6 It is hard to see how this
would provide any illumination of our observed shifts
in the nadir of blood pressure at around 0100–0300.
For critical studies we now compile our data relative
to waking time as well as to absolute clock time.

We are therefore unconvinced that cosinor analysis
would clarify our observations of ambulatory intra-
arterial blood pressure unless applied in a complex
form taking account of many pattern features and fre-
quencies, in which case conventional Fourier analysis
seems to offer more possibilities.

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Delayed recovery of left ventricular function after anti-
thyroid treatment

Sir,

Forfar et al (1984; 52: 215–22) suggest that in hyper-
thyroidism left ventricular function is reversibly
depressed. Their conclusions are based on
haemodynamic measurements performed on 15
hyperthyroid subjects before and during isometric
exercise, and those measurements were repeated after
the subjects had been rendered euthyroid. The
authors stress that hyperthyroidism involves changes
intrinsic not only to the heart itself but also to the
peripheral circulation. They assume, however, that
the performance of a standardised isometric exercise
task produced the same changes in the peripheral cir-
culation in both hyperthyroid and euthyroid states
and, therefore, that exercise caused the same changes
in cardiac loading before and after the subjects had
been treated for their thyrotoxicosis. Nevertheless, as
shown in the Table below, using data taken from their
own paper it may be calculated that isometric exercise
actually caused directionally opposite changes in
peripheral vascular resistance during the thyrotoxic
and euthyroid states. Peripheral vascular resistance is
a major determinant of the impedance offered to the
outflow of blood from the left ventricle. In the study of
Forfar et al the thyrotoxic heart, faced with an
increased peripheral resistance during isometric exer-
cise, did not function as well as it did at rest. In
contrast, the euthyroid heart experienced a large
reduction in calculated peripheral vascular resistance
during isometric exercise and showed no deterioration
in function.

Thus it would appear that peripheral resistance is
an important determinant of basal and exercise
induced left ventricular function in thyrotoxicosis,
and the results obtained by Forfar et al do not estab-
lish the presence of an intrinsic myocardial abnor-
mality in the thyrotoxic state.

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This letter was shown to the authors, who reply as
follows:

Sir,
Northover et al do not indicate how they have deter-
mined systolic and diastolic volumes from the left
ventricular diameters given in our paper. Their
derived stroke volume in the euthyroid state at rest,
for example (19-4 ml) at a measured heart rate of 82
beats/min, gives a cardiac output of 1-6 l/min ap-
proximately, an output so low that it is biological nonsense
in the context of our study. Similarly, their derived
figure for cardiac output in the hyperthyroid group at
rest (2-8 l/min) is over four times less than that of
Merillon et al1 based on direct invasive measurements
(13-1 l/min). We doubt whether the errors and
assumptions involved in the derivation of left ventri-
cular volumes by single element echocardiography2
justify their usage in a study of this type, let alone as
a basis for calculating peripheral vascular resistance.

The conclusion of our study that left ventricular
function is depressed in hyperthyroidism is not
dependent on isometric exercise causing the same
changes in peripheral vascular resistance in the hyper-
thyroid and euthyroid state. Indeed, this is most
unlikely in view of the profound reduction in
peripheral vascular resistance in hyperthyroidism.
During isometric exercise vascular resistance will cer-
tainly be lower in hyperthyroidism. Crude derivation
of vascular resistance from our study (using the for-
mula of Feigenbaum et al for ventricular volumes3)
supports this contention. Despite this reduction in
peripheral vascular resistance, the pre-ejection period
during isometric exercise was significantly longer in
the hyperthyroid (144(4) ms) than in the euthyroid
(135(4) ms) state. This significant prolongation in
exercise pre-ejection period in hyperthyroidism was
maintained after autonomic blockade.

The results of our study suggest reversible abnor-
malities in left ventricular contractile responses to
exercise in hyperthyroidism that may persist for some
weeks after the restoration of a biochemical euthyroid
state.

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with angiocardiography. Arch Intern Med 1972; 129:
461–7.

Table  Effects of antithyroid treatment on left ventricular function

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Source</th>
<th>Hyperthyroid Resting</th>
<th>Hyperthyroid Exercising</th>
<th>Euthyroid Resting</th>
<th>Euthyroid Exercising</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic arterial pressure (mm Hg)</td>
<td>Forfar et al</td>
<td>126</td>
<td>151</td>
<td>119</td>
<td>144</td>
</tr>
<tr>
<td>Heart rate (beats/min)</td>
<td>Forfar et al</td>
<td>99</td>
<td>108</td>
<td>82</td>
<td>93</td>
</tr>
<tr>
<td>Ventricular diastolic diameter (cm)</td>
<td>Forfar et al</td>
<td>4-2</td>
<td>4-3</td>
<td>4-0</td>
<td>4-1</td>
</tr>
<tr>
<td>Ventricular diastolic volume (ml)*</td>
<td>Calculated</td>
<td>38-8</td>
<td>41-6</td>
<td>33-5</td>
<td>36-1</td>
</tr>
<tr>
<td>Ventricular systolic diameter (cm)</td>
<td>Forfar et al</td>
<td>2-7</td>
<td>3-2</td>
<td>3-0</td>
<td>2-9</td>
</tr>
<tr>
<td>Ventricular systolic volume (ml)*</td>
<td>Calculated</td>
<td>10-3</td>
<td>17-2</td>
<td>14-1</td>
<td>12-8</td>
</tr>
<tr>
<td>Ventricular stroke volume (ml)*</td>
<td>Calculated</td>
<td>28-5</td>
<td>24-4</td>
<td>19-4</td>
<td>23-3</td>
</tr>
<tr>
<td>Cardiac output (l/min)</td>
<td>Calculated</td>
<td>2-85</td>
<td>2-64</td>
<td>1-59</td>
<td>2-17</td>
</tr>
<tr>
<td>Peripheral vascular resistance (mm Hg min/l⁻¹)</td>
<td>Calculated</td>
<td>44-3</td>
<td>57-2</td>
<td>74-8</td>
<td>66-4</td>
</tr>
</tbody>
</table>

*In the calculations of ventricular volume the ventricle was assumed to be spherical.