Radioisotope Scanning of the Precordial Distribution of Iodide in Patients with Myocardial Infarction

By Dean T. Mason, M.D., Robert L. Frye, M.D., and Henry N. Wagner, Jr., M.D.

Radioisotope scanning has proved useful as a means of diagnosing pericardial effusion. Ten minutes after administration of human serum albumin labeled with radioiodine, the spatial distribution of the radioactivity throughout the central cardiovascular system is automatically measured and recorded photographically. The diagnosis of effusion is based on comparison of the scanning image of the cardiac blood pool with the roentgenographic image of the heart obtained while the patient is lying on the scanning table.

An additional use of scanning in the field of cardiovascular disease was suggested by Dreyfuss, Ben-Porath, and Menczel. These authors had observed that I-131-labeled iodide concentrated in pulmonary infarcts, and postulated that necroses of the heart might also concentrate this isotope.

Patients with myocardial infarction were studied after the administration of I-131-labeled iodide. Iodide rather than iodinated albumin was used. Counting rates were recorded daily by means of a stationary scintillation detector over the chest wall. The counting rate over the electrocardiographic locations of leads V3 and V5 were determined over both left and right chest. In contrast to the results observed in control patients, all patients with myocardial infarction had at least a 20 per cent higher concentration of radioactivity on the left side of the chest than on the right. On the basis of this finding, the authors suggested that it might be possible to demonstrate areas of myocardial infarction by a radioisotope scanning procedure, although they did not attempt this themselves.

The present study was designed to evaluate the feasibility of outlining myocardial infarctions by a radioisotope scanning technic.

Methods

In essence, the technic consists of automatically recording the spatial distribution of a gamma-emitting radionuclide within the body and is more completely described elsewhere. The scan is obtained with the patient lying in a supine position while two motors move a radiation detector back and forth automatically over the chest. The detector consists of a sodium iodide crystal, photomultiplier tube, and focusing collimator. The radiation coming from the iodine immediately beneath the probe is detected, amplified, and recorded automatically. Background radioactivity is minimized by means of a gamma-ray spectrometer. The radioactivity is utilized to activate a light that exposes x-ray film. The darkening of the film is a function of the amount of radioactivity beneath the detector. Immediately following the scanning procedure, a chest x-ray is taken with the patient lying on the scanning table. The scanning image is superimposed on the x-ray image of the heart by means of localizing markers on both scanning image and x-ray.

The scans were performed 24 hours after administration of 100 to 200 microcuries of NaI-131. This is another difference from the procedure used for detecting pericardial effusion in which case iodinated albumin rather than iodide is administered and the scanning procedure is performed shortly after the intravenous injection rather than 24 hours later. In the present study, all patients received potassium perchlorate prior to the administration of the radioiodine to decrease thyroid uptake of the isotope. Therefore, most of the administered radioiodine was excreted by the kidneys prior to the scanning procedure. Consequently, the radioactivity in the blood was low after 24 hours and any concentration of radioiodine in the area of myocardial infarction would appear as a localized darkened area on the scanning image. Immediately prior to the scanning procedure, we made precordial measurements of the radioiodine concentration beneath a stationary probe over the electrocardio-
graphic positions left V₃ and right V₂. This part of the study duplicated the work of Dreyfuss et al., except that we utilized a 12-hole focusing collimator with a smaller field and better resolution.

A total of 14 scans in 12 patients with clinical and electrocardiographic evidence of myocardial infarction was obtained. In four control patients, the radiiodine content of whole blood and gastric juice was measured in a well-scintillation detector after 100 microcuries of intravenous radiodiode were administered.

### Results

Figure 1 presents the results of the radioisotope scan in two patients with myocardial infarction, illustrating a localized concentration of radiodiode along the diaphragmatic border of the heart. This occurred in four of the 11 scans performed after oral administration of the radiodiode and in all three scans obtained after intravenous administration of the radiodiode. Six of 12 patients had a ratio of 1.2:1.0 or greater when precordial isotope measurements over the left chest were compared with a corresponding position over the right chest. Table 1 summarizes the results.

Although the radiodiode appeared concentrated along the diaphragmatic border of the heart, the possibility was considered that the collection of radioactive material might be in the stomach. Evidence obtained by comparing the concentration of radioactivity in a sample of gastric contents to that of simultaneous blood samples after intravenous radiodiode was administered supported the concept that the radiodiode was concentrated in the stomach. These data are presented in table 2.

### Discussion

The present results strongly suggest that the concentration of radiodiode that occurs over the left chest 24 hours after the administration of I¹³¹-labeled iodide is due to radiodiode concentrated in the cardia of the stomach. This was observed after the intravenous as well as the oral administration of the iodide. Since saliva contains a high concentration of radiodiode, it is possible that swallowed saliva plays some role in the collection of radiodiode in the stomach. It has been reported, however, that the stomach itself has a remarkable capacity to concentrate iodide.³-⁵

Since gastric emptying is delayed in patients who lie quietly in bed, one can postulate

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**Table 1**

**Description of Patients with Myocardial Infarctions**

<table>
<thead>
<tr>
<th>Patient (J.H.H. number)</th>
<th>Area of infarction (ECG)</th>
<th>Time after infarction scan performed (Days)</th>
<th>Dose radiodiode (mc.)</th>
<th>L:R radioactivity ratio</th>
<th>Localized concentration of radiodiode (plus or minus)</th>
</tr>
</thead>
<tbody>
<tr>
<td>963184</td>
<td>Anterior</td>
<td>15</td>
<td>100, oral</td>
<td>1.5:1</td>
<td>+</td>
</tr>
<tr>
<td>944739</td>
<td>Diaphragmatic</td>
<td>16</td>
<td>100, oral</td>
<td>1.8:1</td>
<td>+</td>
</tr>
<tr>
<td>971408</td>
<td>Diaphragmatic</td>
<td>17</td>
<td>100, oral</td>
<td>1.9:1</td>
<td>-</td>
</tr>
<tr>
<td>113200</td>
<td>Anterior</td>
<td>16</td>
<td>100, oral</td>
<td>1.1:1</td>
<td>-</td>
</tr>
<tr>
<td>974711</td>
<td>Diaphragmatic</td>
<td>10</td>
<td>200, oral</td>
<td>1.05:1</td>
<td>-</td>
</tr>
<tr>
<td>490657</td>
<td>Anterior</td>
<td>16</td>
<td>200, oral</td>
<td>1.1:1</td>
<td>+</td>
</tr>
<tr>
<td>343602</td>
<td>Anterior</td>
<td>17</td>
<td>200, oral</td>
<td>1.4:1</td>
<td>-</td>
</tr>
<tr>
<td>177714</td>
<td>Diaphragmatic</td>
<td>12</td>
<td>200, oral</td>
<td>1.3:1</td>
<td>-</td>
</tr>
<tr>
<td>417326</td>
<td>Diaphragmatic</td>
<td>16</td>
<td>200, oral</td>
<td>1.1:1</td>
<td>-</td>
</tr>
<tr>
<td>867798</td>
<td>Anterior lateral</td>
<td>8</td>
<td>200, oral</td>
<td>0.93:1</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>diaphragmatic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>867798</td>
<td>Anterior lateral</td>
<td>15</td>
<td>200, oral*</td>
<td>0.72:1</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>diaphragmatic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>867798</td>
<td>Anterior lateral</td>
<td>17</td>
<td>200, I.V.</td>
<td>1.1:1</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>diaphragmatic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>798921</td>
<td>Not localized</td>
<td>10</td>
<td>200, I.V.</td>
<td>1.05:1</td>
<td>+</td>
</tr>
<tr>
<td>836501</td>
<td>Anterior</td>
<td>21</td>
<td>200, I.V.</td>
<td>1.2:1</td>
<td>+</td>
</tr>
</tbody>
</table>

*Radioiodine given 8 days prior to scan.*
that the enforced bed rest in patients with myocardial infarction would lead to a higher mean concentration of secreted radioiodine in the cardia than that found in patients in whom bed rest is not so strictly enforced. The distribution of radioiodine in the stomach of a normal person kept at rest for 24 hours after the administration of 100 microcuries of sodium iodide (1^31I) \textit{intravenously} is shown in figure 2. The localization of this material in the stomach can be seen superimposed over barium contained in the cardia of the stomach.

Despite the failure of the present investigation to demonstrate the feasibility of outlining areas of myocardial infarction by means of radioiodine, future attempts to scan areas of myocardial infarction with other isotopes may be successful. The present data, however, emphasize the need for caution in interpretation of precordial scans obtained with radioiodine.

\textbf{Table 2}

\begin{table}[h]
\begin{center}
\begin{tabular}{|c|c|c|}
\hline
Patient & Time after & Radioiodine activity ratio (gastric/blood) \\
(J.H.H. number) & radioiodine & \\
& administered (hours) & \\
\hline
(1) 977260 & 24 & 3:1 \\
(2) 466899 & 42 & 5:1 \\
(3) 979280 & 24 & 1:1 \\
& 49 & 1:1 \\
(4) 601386 & 6 & 8:1 \\
& 28 & 8:1 \\
& 100 & 20:1 \\
& 120 & 13:1 \\
\hline
\end{tabular}
\end{center}
\end{table}

\textit{Scintiscan of control patient (601380).}

\textbf{Figure 1}

Summary

Precordial scanning of the distribution of radioiodine (\textsuperscript{131}I-labeled iodide) in patients with myocardial infarction has been suggested by others as a means of delineating the infarcted area.

Attempts to localize radioiodine in 14 precordial scans of 12 patients with myocardial infarction resulted in the demonstration of localized areas of radioactivity in seven scans. This collection of radioactivity was found to be within the stomach, resulting from the normal concentration of radioiodine that occurs in gastric secretions.

References


Thomas Sydenham
1624–1689

Thus it was that Sydenham came to seem to his contemporaries "the English Hippocrates." Unquestionably his medical art and science had in many respects the characteristics of a reaction, and Sydenham regarded himself as a Hippocratist. Like Hippocrates, the basic principle of his medical thinking was the humoral pathology, and like Hippocrates his general outlook upon illness was that it was a natural healing process. Nevertheless there lay a whole world between the two. The decisive difference between them becomes plain in respect of their divergent outlook upon illness as soon as they quit the domain of the general. Hippocrates recognized only disease, not illnesses. He knew only sick individuals, only cases of illness. The patient and his malady were for him inseparably connected as a unique happening, one which would never recur. But what Sydenham saw above all in the patient, what he wrenched forth to contemplate, was the typical, the pathological process which he had observed in others before and expected to see in others again. In every patient there appeared a specific kind of illness. For him maladies were entities, and his outlook upon illness was, therefore, ontological. Hippocrates wrote the histories of sick persons, but Sydenham wrote the history of diseases.—Henry E. Sigerist, M.D. The Great Doctors. New York, W. W. Norton & Co., Inc., 1933, p. 181.
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