Radioactive Sodium Selenite in the Differentiation of Hepatic Lesions

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SUMMARY

Selenium-75 selenite and technetium-99m sulphur colloid scans were performed on 38 South African Blacks with intrahepatic space-occupying lesions. Uptake of selenite was demonstrated in the 'cold area' of the sulphur colloid scan in 17 out of 19 patients with hepatocellular carcinoma, but in 16 patients with amoebic liver abscess there was no uptake of selenite in the 'cold area'. In 3 patients with secondary involvement in the liver, 2 had positive uptake of selenite in the affected region. 75Se selenite was found to be useful in the differential diagnosis of intrahepatic lesions.

Radio-isotopic imaging of the liver is now an established technique in the diagnosis of intrahepatic space-occupying lesions. The most commonly used radiopharmaceutical is 99mTc sulphur colloid, which is taken up in the liver by the Kupffer cells. Tumours are demonstrated as 'cold areas' on the scan but other lesions such as abscesses and cysts may have similar appearances. In order to further define 'cold areas' in the liver, the liver scan can be repeated after injection of a different radiopharmaceutical. To identify a tumour positively would be of considerable value but no satisfactory isotopic agent has yet been found. Dual radionuclide scanning of the liver with a radiopharmaceutical which is concentrated by malignant hepatocytes and not by benign lesions such as abscesses and cysts, is finding increased use in the diagnosis of intrahepatic lesions.

In 1965 the selenite ion was first used as a scanning agent for the detection of cartilaginous tumours by Esteban et al.2 Cavalieri et al.3,4 later studied its use in the detection of brain, bone and lung tumours. More recently there have been other reports on the use of selenite.5,6 These studies have shown that selenite can be useful in differentiating malignant from benign lesions in certain organs, e.g. the liver, the brain and bone, with a high degree of success.

In a series of 50 patients with different hepatic lesions, Esteban et al.2 showed uptake of selenite in the 'cold areas' produced by hepatomas but only 50% of the metastatic abnormalities concentrated the isotope. There was no uptake in the 'cold areas' due to abscesses or cirrhosis. Baptista, in a series of 57 patients with hepatic pathology, found similar results.

Radioactive selenite has been used by us in 38 patients with distinct 'cold areas' demonstrated on the 99mTc sulphur colloid scan and in whom the final diagnosis was definitely confirmed by histology or aspiration biopsy with positive cytology. No necropsy specimens were obtained and hence it was not possible to determine how the gross localization of tumours corresponded with the area demonstrated on the scans.

PATIENTS AND METHODS

99mTc sulphur colloid 1 mCi was given intravenously and the scan was started approximately 15 minutes after injection. A Picker Magna Scanner V with coarse focus medium energy collimator, photodot and colour output was used. Anterior and lateral views were performed in the usual way. Patients who had 'cold areas' on the 99mTc scan were then given a further injection of approximately 250 μCi 75Se selenite and were scanned 30 minutes - 48 hours later. The selenite was not always injected immediately after the sulphur colloid scan and in some cases an interval of a few days occurred.

When the 'cold area' shown on the 99mTc sulphur colloid scan appeared to be filled-in on the selenite scan, the result was termed positive (Fig. 1). If it was not filled-in, the result was termed negative (Fig. 2). The scans were reported by trained medical staff who were unaware of the final diagnosis.

RESULTS

A summary of the results obtained with 75Se selenite is given in Table I. Of the 38 patients studied, 16 were finally diagnosed as having amoebic liver abscesses. The selenite scans showed no uptake in the 'cold area' in all cases. Nineteen patients were diagnosed as having hepatocellular carcinoma, and 17 of them showed positive uptake of 75Se in the 'cold area'. The biopsy specimens of the 2 patients with negative selenite scans showed hepatocellular carcinoma with considerable areas of tumour necrosis. Three patients were diagnosed as having metastatic carcinoma - 2 of them had positive scans and 1 a negative scan. Biopsy in the case of the negative scan showed sarcomatous tissue.

**TABLE I. ANALYSIS OF SELENITE SCANS**

<table>
<thead>
<tr>
<th>Abnormality</th>
<th>Number of cases</th>
<th>Positive scan</th>
<th>Negative scan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoebic abscess</td>
<td>16</td>
<td>—</td>
<td>16</td>
</tr>
<tr>
<td>Hepatocellular carcinoma</td>
<td>19</td>
<td>17</td>
<td>2</td>
</tr>
<tr>
<td>Metastatic carcinoma</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
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Fig. 1. Scan of liver with hepatocellular carcinoma. Top: technetium scan; bottom: selenite scan (24 hours later).

Fig. 2. Scan of liver with amoebic abscess. Top: technetium scan; bottom: selenite scan (1 hour later).

DISCUSSION

These results agree with those of other investigators in the use of selenite for liver scanning. Selenite is taken up in hepatocellular carcinoma but not in necrotic tissue. If a 'cold area' on a 99mTc sulphur colloid scan is filled-in on the selenite scan, the result is indicative of tumour tissue (either primary or secondary). If the lesion is not filled-in, no further information is obtained on the nature of the space-occupying lesion. Caution must be exercised in the interpretation of the selenite scan, since the kidneys are often visualized in scans performed 24 hours after injection of the agent. This can cause a false appearance of filling-in of 'cold areas', particularly those situated in the inferior aspect of the right lobe (Fig. 3). Scans performed 1 hour and 48 hours after injection generally did not show renal uptake, and no advantage was obtained in waiting 48 hours after injection before scanning.

When 'cold areas' were filled-in on the selenite scans, the maximum uptake of selenite in these areas was found not to exceed the uptake in surrounding hepatic tissue. On occasions the degree of uptake of selenite was less than in neighbouring tissue and was patchy in appearance. No edge effects were noted surrounding the walls of proven amoebic abscesses.

The use of selenite in the differentiation of space-occupying lesions of the liver would appear to be superior to that of 75Se selenomethionine and 67Ga citrate. Using 75Se selenomethionine in a similar study of South African Blacks, Kew et al. found a high percentage of false negative scans in 45 patients with primary liver cancer, which they attributed to the anaplastic nature of the neoplasm and the frequency of necrosis. 75Se selenite is considerably less costly than 75Se selenomethionine and has been shown
Fig. 3. Scan of liver with multiple amoebic abscess formation showing uptake in kidneys. Top: technetium scan; bottom: selenite scan (24 hours later).

to be excreted faster, resulting in a lower radiation dose to the whole body."

"Ga citrate is also taken up in hepatic cancer, some tumours showing increased uptake and others equal uptake compared with adjacent liver tissue. "Ga, however, has also been shown to concentrate in liver abscesses." De Roo, in a study on animals, found uptake of selenite in necrotic lesions and abscesses but this does not appear to have been demonstrated on scanning of human hepatic abscesses.

CONCLUSION

The incidence of primary liver cancer is very high among the Black population but there is also a high incidence of amoebic liver abscess. When there is not a clear-cut clinical diagnosis, radioactive selenite has been shown to be useful in the differential diagnosis of space-occupying lesions initially detected on colloidal liver scans. When a malignant lesion is suspected the site and size of the 'cold area' may not be amenable to needle biopsy, and laparotomy or peritonoscopy may be contemplated. There could also be contraindications to biopsy, such as a low prothrombin index. In these instances a positive selenite scan could save the patient further investigation because uptake of selenite would be strong evidence of malignancy. Although $^{75}$Se is not the ideal tracer, owing to its long physical and biological half-life, it can easily be stored for use when required.

REFERENCES


Boeke Ontvang : Books Received


