Preliminary assessment of ^{90}Y ferric hydroxide colloid

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In the treatment of synovitis of the knees ^{90}Y is the radio-isotope most commonly used. Bayly, Peacegood, and Peake (1973) have reported the preparation of this isotope in the form of a colloid of ferric hydroxide (above, p. 10). We have made a preliminary study of the use of this preparation in the treatment of chronic rheumatoid synovitis of the knees and have compared its retention within the knees with that of the citrate colloid prepared by C.E.A. (France).

Material and methods

In this survey fifteen knees (12 patients) were injected with ^{90}Y $\text{Fe}(\text{OH})_3$ colloid and nine knees (5 patients) with the citrate preparation. A standard dose of 5 mCi. in 5 ml. was used unless the knee had been previously treated with a radioactive colloid, in which case 3.5 mCi. was usually given. The knees were aspirated at the time of injection but hydrocortisone and local anaesthetic were not injected into the joint cavity. After injection the knees were placed in plastazote back slabs, and the patient kept strictly at rest in bed for 3 days. Minor relaxations were made on two occasions since one patient had advanced rheumatoid disease of the hip and the other had previously suffered from bed sores.

The amount of radioactivity in each knee was measured within 1 hour of the injection and this value was taken as 100 per cent. of the dose. Measurements were repeated 1 day and 5 days after the administration of the isotope, when estimations of the activity in the groins and liver were also made. A hybrid scanner (Crawley and Veall, 1973) was used routinely, and measurements were also made using two opposing 3" crystals 44 cm. apart with lead and aluminium filters in front of the counters. This latter system was thought to be better for differentiating between the knees when both knees had been injected, but proved unsuitable for estimating the amount of activity present in the groins or liver. Agreement between the two systems was good when radioactivity was present in one knee only. All patients were scanned on Day 1 to check the distribution of the isotope and calculations of the amount retained were made using the technique previously described (Williams, Glass, Arnot, Goolden, and De Garreta, 1969). This gave results in reasonably good agreement with the other two methods, but it was noticed that, if the activity had dispersed over a larger area than expected, the double-headed technique tended to underestimate the amount of activity retained.

Results

There were no short-term side-effects from the injections. Pain was minimal and there was no pyrexia or systemic upset. A warm effusion was usually present next morning but there were no problems around the injection site.

The retention of the $\text{Fe}(\text{OH})_3$ was little different on the whole from results previously published for the resin and citrate preparations (Gumpel, Farran, and Williams, 1974); the results for all the patients on the fifth day after injection are shown in the Figure, together with the results previously found. Leakage of activity from the knee to the groin was found in eight patients (11 knees).

FIGURE Retention on 5th day of ^{90}Y ferric hydroxide colloid compared with that of citrate colloid. For comparison, the retention of resin colloid and citrate colloid obtained in a previous study are also shown. The mean retention of each colloid is indicated.

Some activity could be detected after 24 hours (1 to 25 per cent.) and the amount usually increased after 5 days (3 to 26 per cent.). Four of these patients had had citrate and four ferric hydroxide. The degree and timing of lymph node uptake was not markedly different for the two preparations. Three of these patients also had leakage to the liver amounting to up to 17 per cent. of the initial dose. Why leakage occurred from some knees and not from others was not explained. It did not appear to be due to the type of colloid, clinical factors, or the total dose of isotope injected.

One patient was found to have less than 30 per cent. of the dose still in her knee after 5 days, but she had 25 per cent. in her groin on both Day 1 and Day 5. A scan of the knee was done on both these days and there was very little increase in the area over the region of the knee through which the colloid had disseminated between Days 1 and 5. This patient had been injected with the new preparation, but another patient who had this colloid injected into her right knee retained 90 per cent. of the dose in that knee after 5 days, while the left knee which had been injected with the citrate had only 40 per cent. remaining with more than 20 per cent. in the groin and nearly as much in the liver.

The numbers in this survey are very small, but it seems to us that the new ferric hydroxide colloid is comparable with the citrate and resin preparations and could well take the place of ^{90}Y resin which is now no longer available.

Discussion

DR. DOLPHIN There seems to have been a doubt throughout the talks today on the particle size involved in any individual batch or injection. It is possible with the modern techniques of ultra-filtration, using millipore or amicon filters, to define the particle size of the colloid before injection.

DR. PEAKE I certainly think that this should be possible. There is no obvious reason why this sort of filtration could not be carried out to give a uniform particle size over a narrow range, but the difficulty is to decide what particle size is required for the job. We try to give a range of particle size at about the value suggested by most of those conducting trials of this treatment, and this is why we have chosen the ^{90}Y ferric hydroxide.

DR. DOLPHIN It seems to me that you will never find the appropriate particle size the way things are going at the moment.

PROFESSOR INGRAND I have just one comment. This is a very very difficult point. It would be preferable if Professor Marignan of Montpellier would speak about colloids. When you look at a colloid you must be aware that there are two parts, first the middle and then a surround which may include all kinds of things. So that what you see under the microscope is not the true size. Moreover, physical forces interact. The conclusion is that if we take a pore measuring 100 nm. in diameter, we cannot be sure that colloidal particles of a smaller diameter will pass through it.