Gall-bladder and colonic retention of SeHCAT: a re-evaluation

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Abstract. A number of suggested alternatives and emendations to the 7-day SeHCAT retention test have been compared with whole-body counting. It was found that correction for colonic retention is an unnecessary complication in patients with diarrhoea and that imaging either of the gall-bladder or of the distribution of activity in the intestines at 24 h does not add useful information to the standard 7-day retention measurement. Neither could the patterns of colonic uptake identified in patients following extensive ideal resection or radiotherapy be reproduced in patients with idiopathic diarrhoea. Sadly it must be concluded that neither of these shortened techniques is of clinical value in patients with intact small bowel and that there remains no reliable alternative to the 7-day SeHCAT retention test. The simplest technique the best.

Key words: Seven-day SeHCAT retention – Gall-bladder – Colon


Introduction

Bile acid malabsorption is a debilitating condition which is readily treatable but substantially under-diagnosed [1, 2]. Diagnosis requires measurement of faecal bile acids, the faecal excretion of orally administered carbon-14 taurocholate over several days or SeHCAT retention. The latter measurement is simple and accurate, eliminating the need to collect and process faeces, but suffers from the disadvantage that it requires measurement of radioactivity remaining in the patient 7 days after ingestion of the tracer dose. Any technique enabling this period to be reduced would be clinically attractive. Ferraris et al. [3] suggested measurement of uptake in the gall-bladder, with correction for residual activity in the colon by means of a second, non-absorbed, tracer. However, Smith and Bjarnason [4] pointed out that the single transit of an inert marker was not a valid indicator for what is in effect a constant infusion into the caecum of bile acids, which continuously recirculate and in the normal subject have a greater than 95% absorption on each pass through the ileum. Additionally they drew attention to methodological weaknesses in the dual-isotope counting technique employed. Valdes Olmos et al. [5], in a small group of patients who had undergone moderately extensive small bowel resections, suggested that imaging of the abdomen at 48 h was useful to distinguish rapid transit from true bile acid malabsorption. Neither group compared their results with the standard reference method, namely whole-body counting. We have therefore compared measurements of gall-bladder uptake and imaging at 24 h with measurement of whole-body retention at 7 days in a consecutive group of patients being investigated for possible idiopathic bile acid malabsorption.

Materials and methods

Thirteen consecutive patients referred for routine clinical SeHCAT retention measurements were studied. It was explained to them that this study involved an additional visit to the hospital at 24 h, which was not part of their routine measurement. Patients whose journey to the hospital could have taken more than an hour were not approached. All who were asked agreed to participate. The study had the prior approval of ARSAC and of the Area Ethics of Research Committee.

A capsule containing 400 kBq of $^{75}$SeHCAT was administered orally after an overnight fast. In accordance with our normal protocol, $^{58}$Co uptake was measured simultaneously using 40 kBq cobalt-58 cyanocobalamine. Measurements were made on a shadow shield whole-body counter as described previously [6]. In addition to the normal protocol the patients returned at 24 h, having fasted from 10 p.m. the previous evening. Supine anterior and posterior 10-min views of the abdomen were taken using a gamma camera set to the three upper peaks of selenium and equipped with a high-energy collimator. Because of the difference in administered activities and the low sensitivity of the gamma camera to the high-energy primary gamma emission of $^{58}$Co (and much of its scatter spectrum), scattered radiation from the latter made a negligible contribution to the detected count rate in the $^{75}$Se windows or its observed distribution.

Results

All subjects with a 24-h gall-bladder uptake greater than 15% had 7-day whole-body retention values within the
normal range (>10% of the administered activity). However, only two of six individuals with a gall-bladder uptake below 15% had a whole-body retention of under 10%. No other cut-off value gave better separation of normal from abnormal. Colonic activity was observed in three patients, all of whom had a 7-day retention of over 20%, well within our normal limits. No colonic activity was visible in one patient on an elemental diet who had no bowel motions during the 7-day period. In this patient almost all remaining activity was concentrated in the gall-bladder at 24 h. This patient’s 7-day retention of SeHCAT was 86%, suggesting some urinary excretion. A scatter plot of retention measured by whole-body counting at 7 days against gall-bladder uptake at 24 h is shown in Fig. 1. There was no correlation between whether or not radioactivity was visible in the colon at 24 h and the 7-day whole-body retention.

Discussion

Whole-body counting is the standard reference technique for measuring SeHCAT retention. However, whole-body counters are not as widely available as gamma cameras and a technique which can be applied using more generally available equipment has considerable attraction. An uncollimated gamma camera is most widely employed, but care must be taken that the background does not vary during the measurement period. A priori the signal-to-noise ratio might be improved if a low-energy collimator were added, as in most departments of nuclear medicine the major contribution to background is technetium activity. Surprisingly this possibility does not seem to have been tested. Such a collimator would attenuate the higher energy primary emissions of $^{75}$Se to a much smaller extent than the lower energy scatter. The normal range for 7-day retention has recently been revised [2] and the lower limit of normal reduced to 10%, from the earlier suggested value of 15%.

There is a range (between 5% and 10%) where there is overlap between rapid transit and true bile acid malabsorption. In our previous study [2] we found that six of 16 patients with a 7-day retention greater than 5% and less than 10% responded to cholestyramine whilst ten were symptomatically controlled by agents such as loperamide reducing the rate of bowel transit. It is plausible that imaging might have some role in these patients. However, by 7 days the residual activity is usually too low to be imaged adequately. Valdes Olmos et al. [5] observed colonic activity at 24 h in two of seven patients whose bile acid malabsorption was due to radiation damage or resection and who had a 7-day retention of 5% or less. All of our patients, who had irritable bowel syndrome or idiopathic malabsorption and none of whom had received radiotherapy or bowel resection, showed some small bowel activity at 24 h, although they were attending early in the morning after an overnight fast, but activity was identifiable as being definitely in the colon only in two, one with a 7-day retention of 0.5% and a second whose retention was 9% (Fig. 1). The gall-bladder was visualised in all patients at this time, suggesting that they had indeed been fasting. Ferraris et al. found a rather poor correlation between gall-bladder retention and whole-body retention. Our observation that even in fasting subjects there is a substantial but variable amount of activity in the small bowel offers an explanation for this. There is no simple procedure which could overcome this problem. Taking 10% as the lower limit of normal for gall-bladder retention would have misdiagnosed one of the two patients who did have a 7-day retention below 10% (that is, a false-negative rate of 50%) whilst a cut-off of 15% gives a false-positive rate of 66%. Thus, although it would appear from the scatter plot that there is a weak correlation between whole-body and gall-bladder retention, it is clear that in the critical lower range the degree of overlap is such that 24-h gall-bladder retention is not a reliable way of differentiating bile acid malabsorption.

Ferraris et al. [3] suggested also that activity retained in the large bowel was a potential source of error and attempted to use a non-absorbed marker to correct for this. Their impression was based on their experience with normal volunteers. However, the clinical role of SeHCAT is in patients with rapid bowel transit and diarrhoea, and the absence of appreciable large bowel activity in 11 out of our 13 subjects is in agreement with the clinical impression that retained radioactivity in the colon is not a significant source of error in clinical practice in patients with diarrhoea. The original suggestion that the retention should be measured at 7 days was based on a number of factors, including the convenience of being able to set up the equipment on only 1 day a week. However, the major consideration was the evidence provided by long-term whole-body counting. This confirmed that the whole-body retention curve, including the initial measurement and the 7-day value, closely fitted a single exponential for at least 8 weeks [7]. Fitting a single ex-