Clinical usefulness of ^{99m}Tc-HIgG scintigraphy for the abdominal inflammation

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Abstract This study was designed to evaluate the efficacy and safety of ^{99m}Tc labeled human IgG as the tracer for detection of focal inflammatory lesion in abdomen. 61 inpatients with 20 documented cases of pelvicellulitis, 41 cases of inflammatory bowel diseases were studied. All their diagnosis were based upon clinical signs and various types of laboratory data and other imaging modalities. 370~740MBq/mg of ^{99m}Tc-HIgG was injected intravenously. The whole body scan (Ant and Post views) were obtained 1, 2, 4, 6, 24 hours after injection, delayed imaging were repeated if necessary. Wherever abnormal areas, multiple spot views were added. ^{99m}Tc-HIgG was avidly taken up by acute pelvis inflammation lesions and performed less well in 2 chronic cases, so the positive rate was 90%. 21 out of the 22 ulcerative colitis were positive, the positive rate was 93%. 17 out of the 19 Crohn's were positive, the positive rate was 89%. All the negative cases were not active ones. With respect to the activity of the disease, the positive rate of ^{99m}Tc-HIgG scan in ulcerative colitis was 100% equal to that of endoscopy. In Crohn's disease the positive rate was 100%, while endoscopy and X-ray were 30% and 94% respectively. If both diseases were in their relief stage,the scans were normal. Thus ^{99m}Tc-HIgG is proved to be effective in detecting the focal site of inflammation in the abdomen. Providing clinically useful assessment of disease activity and patient's response to therapy, ^{99m}Tc-HIgG scintigraphy is safe, convenient with no side effects. Physiological accumulation in some organs such as the liver makes it difficult to localize.

Keywords ^{99m}Tc-HIgG SPECT imaging, Crohn's disease, Ulcerative colitis, Pelvicellulitis

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1 INTRODUCTION

Ulcerative colitis and Crohn's disease can be defined as inflammatory bowel disease (IBD), and pelvicellulitis is a very common disease in women. Conventionally, the diagnostic techniques of abdominal infection are endoscopy, X-ray, ultrasound, CT and so forth. As we know, a large number of radiopharmaceuticals for inflammation and infection imaging have been used for about 30 years. Recent advances in radiopharmaceutical sciences have provided a plethora for diagnosis of inflammatory and infection. These agents make it easier to determine the extent and activity of disease and to monitor patient's responses to the therapy[1]. ^{99m}Tc-labeled human polyclonal immunnoglobulin is among the major categories of radiopharmaceuticals for inflammation imaging.

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2 MATERIALS AND METHOD

2.1 Patients

61 patients (33 males and 28 females, mean age: 35±15y, ranging from 20 to 50 years) were studied with 20 cases of documented pelvicellulitis, 41 cases inflammatory bowel diseases. The diagnosis of above-mentioned patients was based upon standard clinical criteria. All IBD patients have experienced endoscopy and X-ray,meanwhile pelvicellulitis patients have undergone ultrasound. Also we had 11 controls.

2.2 Instruments and protocol

SPECT Orbital ZCL 3700 made by Siemens with low energy, all purpose common collimator was applied.

370-740 MBq/mg of ^{99m}Tc-HIgG provided by Syncor Pharmaceutical Limited Company was injected intravenously. Whole body images including anterior and posterior views were obtained at 1, 2, 4, 6, 24 hours, delayed image repeated if necessary. In addition, multiple spot views, each consisting of 500×10^3 counts, were added and tomographic imaging of the abnormal areas were performed.

3 RESULTS

(1) 21 out of the 22 ulcerative colitis patients were positive, one was negative, so the positive rate was 95%. The typical appearance of ulcerative colitis on a ^{99m}Tc-HIgG scan was generally seen as tubular activity corresponding to segments of the colon. During the delayed imaging, the activity did not move forward with the time, Fig.1. While 17 out of the 19 Crohn's were positive, two were negative, therefore the positive rate was 89%. The scintigraphic features showed that tubular activity favoured in ileum, very seldom in the right colon. Additionaly, the bowel activity progressively increased with the time, Fig.2. The initial images in control group showed activity appeared to be accumulated in blood infused organs such as heart, lung, liver, kidney and bone marrow and faded gradually. However, there was no physiologic uptake in the bowel, Fig.3. All control images were negative. In 20 cases of pelvicellulitis, 18 were positive, the positive rate was 90%. The persistent increased uptake could be visualized within pelvis, Fig.4. The results are summarized in Table 1.

Table 1 ^{99m}Tc-HIgG imaging results

	Number	Positive	Egative	Positive rate/%
Ulcerative colitis	22	21	1	90
Crohn's disease	19	17	2	89
Pevicellulitis	20	18	2	90
Control	11	0	11	0

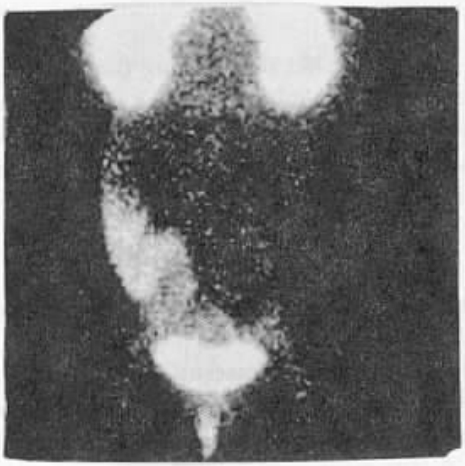

Fig.1 ^{99m}Tc-HIgG 5h delay scan in ulcerative colitis showing that the ascending colon was involved

Fig.2 Abonrmal uptake of ^{99m}Tc-HIgG in the small interstine at 5 h delay

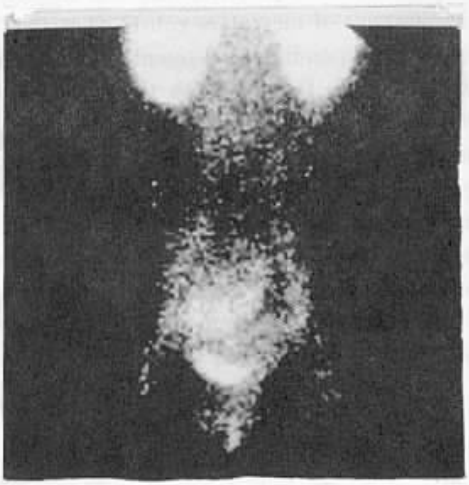

Fig.3 Anterior planar ^{99m}Tc-HIgG image of the pelvicellulitis patient at 5 h, the abnormal activity within pelvis

Fig.4 Normal scan 3 h after injection of ^{99m}Tc-HIgG

(2) 21 out of the 22 ulcerative cases were in active stage, one in relief stage. we compare the results of X-ray, endoscopy and ^{99m}Tc scan, the results are shown in Table

2.

Table 2 Comparison of the results using X-ray and endoscopy in patients with ulcerative colitis

	Activity stage	Relief stage	Positive rate/%
^{99m}Tc scan	21/21	0/1	100
Endoscopy	21/21	0/1	100
X-ray	19/21	0/1	90

(3) 17 out of the 19 Crohn's disease were in activity stage, while 2 were in relief stage. Table 3 is a comparison of the results using X-ray, endoscopy and ^{99m}Tc scan.

Table 3 Comparison of the results using X-ray and endoscopy in patients with Crohn's disease

	Activity stage	Relief stage	Positive rate/%
^{99m}Tc scan	17/17	0/2	100
Endoscopy	5/17	0/2	30
X-ray	16/17	0/2	94

(4) 18 out of the 20 pelvicellulitis were acute, 2 were in chronic stage. We compare ^{99m}Tc scan with ultrasound. Table 4 illustrates good concordance between them.

Table 4 Concordance between the results using both mehtods in patients with acute or chronic pelvicellulitis

	Acute stage	Chronic stage	Positive rate/%
^{99m}Tc scan	18/18	0/2	100
Ultrasound	18/18	0/2	100

4 DISCUSSION

Up to now, the mechanism of inflammation uptake of radiolabeled IgG is not well understood. More recently, most hypotheses have been proposed that it is associated in part with increased vascular permeability and in part with binding to the Fc receptor expressed by infiltrating cells[2,3]. Thus some reports claimed that the type and the virulence of pathogens may determine the extent and sensitivity of IgG localization. Although labeled WBCs have had undisputed success in detecting inflammations, there are significant limitations: WBC labeling is a time-consuming process that requires special facilities and technical expertise. Because of these limitations, its wide use has been hampered. In addition, a significant disadvantage of imaging with ^{99m}Tc-HMPAO-WBC is the presence of " physiological" bowel activity which may give rise to false positive results. In contrast, the novel method of ^{99m}Tc-HIgG is simple, easy available, and stable with no physiological bowel activity, so it could be widely used from the kit[4]. Moreover, if the labeling facilities are not well prepared or other conditions are not satisfactory, usually ^{99m}Tc-HIgG becomes a good choice to replace ^{99m}Tc-HMPAO-WBC. HIgG was first introduced for labeling ^{111}In, ^{111}In is more stable than ^{99m}Tc, and higher target-to-background ratios have been observed with ^{111}In-HIgG than with ^{99m}Tc-HIgG, and due

to its half life, the image can be obtained 48 hours after injection. So, ^{111}In has better image compared with ^{99m}Tc-HIgG. However, with respect to its expensive price, higher radiation dose to patients, ^{99m}Tc-HIgG can take its place in the clinical application, especially in the abdominal inflammation.

The characteristics of IBD are repeating, alternating between activity and relief stages, and long disease process. Lately, the conventional techniques are X-ray, endoscopy and biopsy, but not all patients can tolerate these examinations well, especially to the old and the severe patients. For instance, when IBD patients in severe active stage, endoscopy may result in some complications such as bleeding. ^{99m}Tc-HIgG is a safe, non-invasive method, for the dose of HIgG is less than 1 mg. So even severely ill patients can tolerate this examination[5]. ^{99m}Tc-HIgG has no physiological activity in GI tract, thus bowel preparation is not needed and can be used repeatedly. In our investigation, the optimal images were obtained after 4~6 hours delays. It can not only provide disease extent but also disease activity in IBD. Furthermore, it can also provide additional information regarding extraintestinal complications by whole body scan[6]. Meanwhile, our study implies ^{99m}Tc-HIgG results are closely related to those with ultrasound. Moreover, ^{99m}Tc-HIgG is useful in acute pelvicellulitis, but it is less useful in chronic phase, because, apart from the problem of variable blood pool activity, delayed image (up to 24 or 48 hours) can not be performed.

In conclusion, the uptake of ^{99m}Tc-HIgG was found to be nonspecific. It can both assess disease extent and disease activity. The most important advantage is its efficacy in the diagnosis, monitoring responses to therapy. With respect to its tolerance, convenience, radiation dose and image quality, this method seems superior to conventional ones, but it is not a substitute for radiology, endoscopy and ultrasound in the primary diagnosis. It is only a complimentary or alternative agent for the assessment of abdominal inflammation.

References

1 The P R C Health Ministry. Guidelines of diagnosis and treatment in nuclear medicine (in Chinese). Beijing: Sci Technol Press, 1997, 256~64
2 Jiang Mao-Song. Foreign Med Sci Sect Radiat Med Nucl Med (in Chinese), 1997, **21**:272~76
3 Oyen W J, Boerman Q C, Vander laken *et al.* Eur J Nucl Med, 1996, **23**:459~62
4 Buijs W C, Oyen W J, Dams E T *et al.* Nucl Med Commun, 1998, **19**:743~51
5 Singh A K, Mishra P, Kashyap R, *et al.* Nucl Med Biol, 1994, **21**:277~78
6 Scholmeroch J, Schmidt E, Schumichen C *et al.* Gastroenterology, 1988, **95**:1287~93