

Image Enhancement of Computer-Acquired Gastrointestinal Bleeding Images

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Gastrointestinal (GI) bleeding may be detected using a noninvasive nuclear medicine imaging procedure to assess and/or localize specific areas of hemorrhage in patients who may be actively bleeding (1). However, dilution of tracer in the bowel may cause difficulty in interpretation. Image enhancement of computer-acquired images allows optimum display of a wide count range of information to aid the nuclear medicine physician in interpretation. A case is reported in which this enhancement technique was utilized for proper diagnosis.

CASE REPORT

An 83-yr-old white female with prior history of GI bleeding and persistent blood in her stools was referred to nuclear medicine for a GI bleeding study. The patient was given 10 mCi ^{99m}Tc -sulfur colloid (SC) intravenously and subsequently imaged. Sequential 300-sec analog images were acquired on a standard large field of view gamma camera*, which was interfaced to an imaging computer.† Imaging was carried out for 45 min, and data were stored on a floppy disk. An apparent bleeding site was noted on the first three images (Fig. 1) in the right lower quadrant; however, subsequent images showed diminished radiotracer activity at the site. It was suspected that dilution of radiotracer in the bowel was the cause of the apparent diminished activity on the later images. In order to determine if this was the case, image enhancement was performed.

RESULTS

Digital playback images (2) were obtained at a constant gray scale for the entire study (Fig. 1); as well as digital images re-exposed at different and decreasing gray scale levels to enhance the regional count information of the area in question. The digital images obtained at the decreased gray scale demonstrate the biologic clearance of the radiotracer uptake in the right lower abdominal quadrant through the bowel (Fig. 2). Confirmation of the site of the suspected bleed by angiography was not possible due to the inability to catheterize the artery of choice.

DISCUSSION

Maximum contrast of GI bleeding site/background occurs at the completion of the extraction of the intravascular activity

by the target organ (3-4). Extraction of ^{99m}Tc -SC by the reticuloendothelial cells is completed within 12-15 min. Therefore, images which demonstrated decreasing activity over time were contrary to the expected appearance. Decreasing the gray scale levels is accomplished by changing the contrast and background levels on any computer system. The smaller the range between low and high values will be represented as a high contrast image and vice versa. To confirm the hypothesis of the radiotracer into and through the bowel (1), images with increased intensity and contrast were obtained.

Image enhancement can allow the nuclear medicine technologist to display data and obtain images in a way that shows the wide range of regional count rates, which cannot be displayed adequately with one film exposure setting. This can aid the nuclear medicine physician in the interpretation of the study, but caution must be observed by the physician and the technologist in enhancing images and attempting to correlate information with the patient's history, when in fact, it may not have any clinical significance. The potential pitfalls introduced with contrast enhancement would entail misrepresentation of normal variants that otherwise may not be noticed on regular exposure or gray level settings. Image enhancement must always be recognized and brought to the attention of the nuclear medicine physician. Other pitfalls would include too much background subtraction or too much contrast variance for differentiation of structures.

CONCLUSION

Image enhancement can and has allowed more information from a wide range of count density regions to be displayed to aid in evaluation. This enhancement must be brought to the attention of the physicians reviewing the images, and the patient's films must be labeled appropriately to avoid misinterpretation.

NOTES

* ZLC 750, Siemens Medical Systems, Schaumburg, IL

† Scintiview, Siemens Medical Systems, Schaumburg, IL

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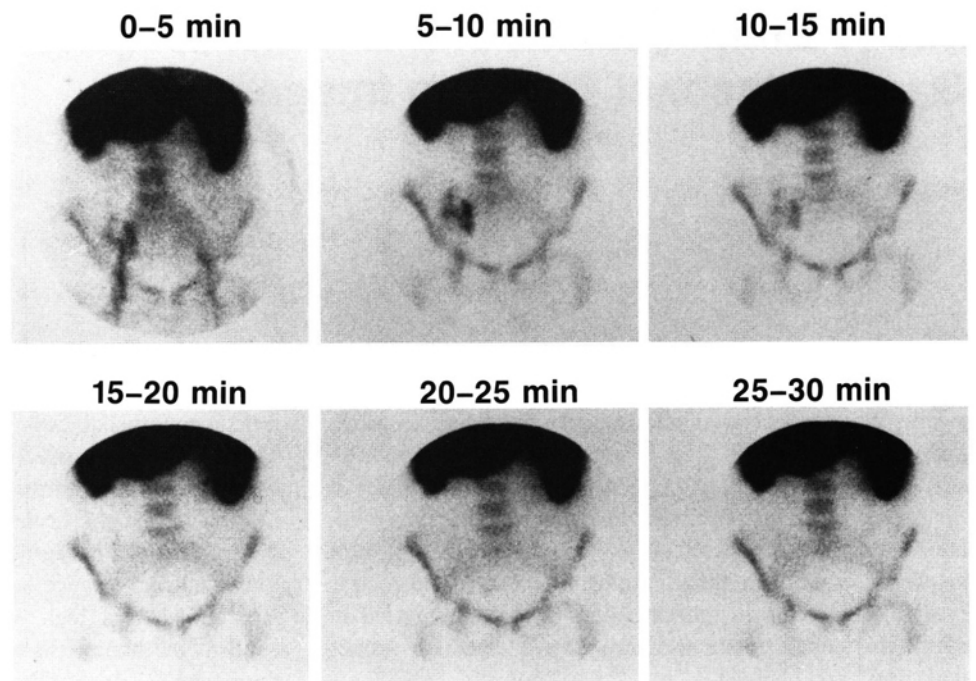


FIG. 1. Constant gray scale images of GI bleed study. Note decreasing intensity in the right lower quadrant.

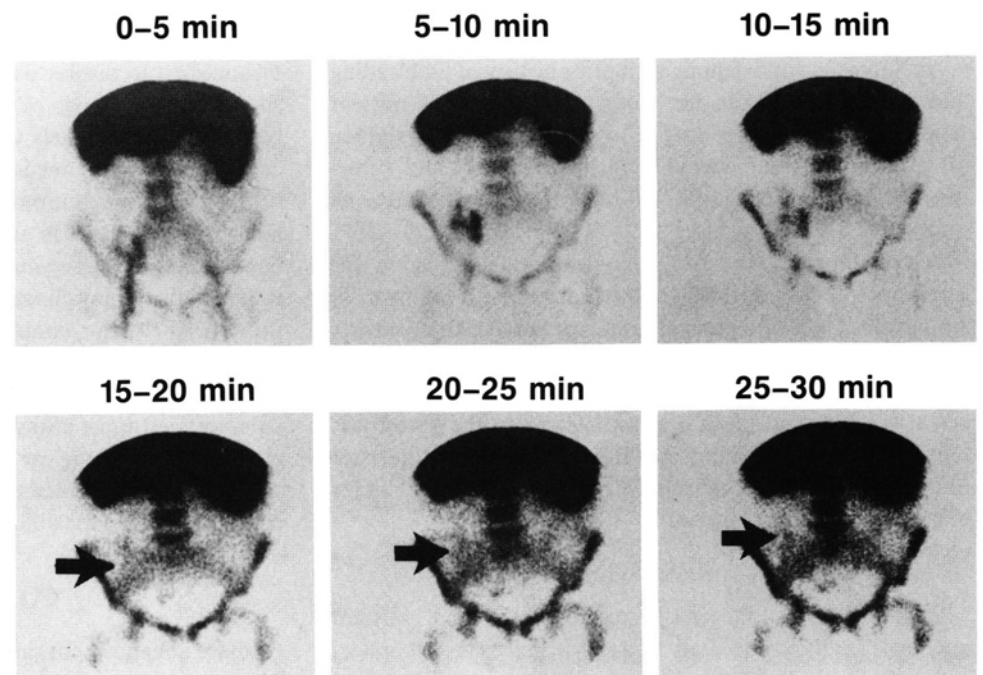


FIG. 2. Decreasing gray scale images of GI bleed study. Arrows denote dilution of radiotracer into the bowel.

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