SPECT/CT

TO THE EDITOR: We read with interest the article "SPECT/CT" by Buck et al. (*1*). The authors nicely summarize the benefits of multimodality imaging. Furthermore, the issue of software based image coregistration is mentioned in this continuing education paper. Until recently, the software to fuse images from different modalities has remained a problem and certainly has not been easy to deal with. In our daily routine work, we experienced 2 difficulties. First, the registration tools were not available in the image-processing workstations that we use in our routine work. Second, the algorithms were not fully automatic and required manual adjustments.

Since January 2008, our nuclear medicine department has been clinically evaluating a new software tool (Volumetrix Suite; GE Healthcare) that incorporates a fully automatic rigid registration algorithm into our image-processing workstation and also enables the creation of dual-modality, fused, 3-dimensional, volume rendered images. With this software tool, we can register a low-dose CT scan with a high-dose CT scan, register scans obtained of the same patient but with different radiopharmaceuticals, and monitor a patient's response to treatment and the evolution of the disease. The registration and segmentation is performed using the National Library of Medicine Insight Segmentation and Registration Toolkit, an open-source software system to support the Visible Human Project (*2*). The algorithm implemented for the image registration protocol consists of a preprocessing step (initial reformatting of target and reference images, optimization by applying 1 of 3 thresholds [bone, soft tissue, or brain], and resampling of the datasets) followed by the registration of the datasets. The datasets are registered by minimizing the cost function using a least mean squares approach in the x, *y,* and *z* directions, followed by applying the final rotation and translating to the target hybrid CT image and to the SPECT/PET image. Furthermore, the software package provides us with the tools to enable a 3-dimensional review of volume datasets by using rendering software that applies OpenGL (Silicon Graphics, Inc.) libraries and a flexible graphical user interface. Predefined anatomic presets (abdomen and bone, among others) allow the easy creation of dual-modality, fused, 3-dimensional, volume rendered images (SPECT/CT or SPECT/external CT).

To validate this software tool, we performed more than 50 SPECT/CT acquisitions of different organs, using different radiopharmaceuticals. After visual registration with an external CT scan, the fused datasets were examined by 3 nuclear medicine specialists. In 50 patients, additional clinical data were obtained or clinical information was improved, whereas in 6 other patients no additional clinical information was obtained. Furthermore, an additional advantage of the 3-dimensional visualization of fused volume datasets was the fact that the clinical findings were easily visible to clinicians not used to SPECT data interpretation. Because the implemented algorithm is rigid, some misregistration could not be avoided, especially if the patient could not be positioned identically in the 2 examinations to be registered (e.g., different arm positions). We solved this problem by visually finding the optimal translation position for the organ of interest or even for only part of this organ.

REFERENCES

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REPLY: We thank Dr. Knoll and coworkers for their comments regarding our recent continuing education article on hybrid imaging with SPECT/CT (*1*). In their letter to the editor, they report on their experience with a new software tool for image fusion (Volumetrix Suite; GE Healthcare). In more than 50 patients examined with this new tool, Knoll et al. observed an improvement of the diagnostic information in more than 89% (50/56) of imaging studies. As outlined in our article, software-based image fusion is still attractive. It would be highly interesting to learn how this new software approach affects various imaging situations in SPECT. The authors are therefore encouraged to submit an original article reporting their results in more detail.

Current software algorithms already allow the highly accurate coregistration of anatomic and functional images, therefore representing a regular component in daily clinical practice, for example, for image-guided surgery or radiation treatment planning. Whereas software-based image fusion seems appropriate in certain clinical situations, we hypothesize that hardware image fusion using integrated SPECT/CT scanners outperforms software-based algorithms in several scenarios. It has been previously demonstrated that motion artifacts arising from separate acquisition of CT and SPECT may seriously affect the accuracy of image fusion in the thorax, abdomen, or pelvis (*2,3*). Typical functional images of the thorax or the abdomen contain insufficient anatomic landmarks for their correlation to anatomic reference points. Differences in patient positioning and respiratory motion make the correct alignment of anatomic and functional images from separate devices even more complicated. Because of these issues, software algorithms did not reach widespread clinical use for