Incremental value of retrospective SPECT CT software fusion imaging for neuroendocrine tumors

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- Patient: 50-year old male
- Clinical history: the patient was diagnosed with a non-hormone-producing, well-differentiated neuroendocrine tumor of the small intestine. A wide resection of the small intestine was practiced. Intraoperative examination of the gut did not disclose any other tumors in the intestinal mucosa. The patient recovered well and remained asymptomatic.
One year after surgery his cancer surgeon ordered an abdominal CT scan that was interpreted as unremarkable.

Three months later he was also examined by his cancer endocrinologist whom in turn also decided to order a somatostatin receptor scintigraphy.
Abdominal CT scan. Initially interpreted as unremarkable.
Three months after the abdominal CT scan, somatostatin receptor scintigraphy disclosed a prominent focal uptake located anteriorly and medially to the upper pole of the right kidney, in the pancreato-duodenal area.

SPECT images. Radiopharmaceutical: $^{99m}$Tc-HYNIC-Tyr3-Octreotide. Activity: 18 mCi
In spite of non-concurrent imaging, SPECT CT software fusion was performed.

The abnormal uptake corresponded to what the radiologist now recognized as a cystic metastasis located in what originally looked like the duodenum’s lumen.

The patient was scheduled for further surgery.
Discussion

Hybrid somatostatin analog SPECT/CT imaging provides incremental diagnostic value and greater reader confidence over planar and SPECT imaging. This is achieved though superior lesion localization, the identification of physiologic activity and additional anatomic information derived from the non-diagnostic CT portion of the study.

Different imaging tables, patient positioning and organ movement will give rise to difficulties in correct image coregistration when using software fusion. Part of the problem can be circumvented by carefully reproducing patient positioning and by the use of radio-opaque and radioactive external markers.
Discussion

There is no way to deal with physiologic bowel movement and it will definitely be a source of image mis-coregistration, even more when fused images are non-concurrent.

Notwithstanding the above-mentioned difficulties, in selected cases a clear benefit will be obtained from retrospective SPECT CT software fusion, even without external markers.
Teaching Points

SPECT should be a customary practice in cancer centers, either when using cancer tracers (e.g., In-111 or Tc-99m octreotide, I-131 sodium iodide, I-131 MIBG, Ga-67 citrate, Tc-99m(V) DMSA, Tc-99m MIBI) or not (e.g., Tc-99m MDP).

In recognition of the incremental value of image fusion, nuclear medicine technologists should always consider the potential medical necessity to retrospectively fuse non-concurrently obtained SPECT and CT or MR images.

Nuclear medicine technologists should always follow a rigorous protocol to facilitate future image coregistration, including careful and reproducible patient positioning and using (radio-opaque and radioactive) external markers in a routinely fashion for every SPECT acquisition.
References

