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# $^{153}\text{Sm}$ -EDTMP Appears to Accumulate Only Trivially Within Peritoneal Ascites

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$^{153}\text{Sm}$ -lexidronam (EDTMP) is a therapeutic radiopharmaceutical used for palliation of pain resulting from osseous metastatic disease. **Methods:** We recently treated with  $^{153}\text{Sm}$ -EDTMP a patient who had extensive osseous metastases and malignant ascites requiring intermittent drainage from an indwelling catheter. Because we could find no useful data regarding quantification of accumulation of this agent within ascites, we opted to assay the fluid after treatment. **Results:** The measured ratio of  $^{153}\text{Sm}$ -EDTMP activity in peritoneal fluid (1.71 L) relative to injected dose was 0.01% (i.e., trivially above background level). **Conclusion:** To our knowledge, this represents the first published measurement of  $^{153}\text{Sm}$ -EDTMP accumulation within peritoneal fluid. This information may be useful to the nuclear medicine community since malignant ascites is not uncommon in patients with widely metastatic carcinoma and such patients may be referred for  $^{153}\text{Sm}$ -EDTMP therapy.

**Key Words:** bone; oncology; radiation safety; radionuclide therapy; radiopharmaceuticals

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**T**he therapeutic radiopharmaceutical  $^{153}\text{Sm}$ -lexidronam (EDTMP) is used for palliation of bone pain resulting from multifocal osseous metastatic disease that has evoked an osteoblastic response on bone scintigraphy (1,2). After intravenous injection, this agent is taken up at sites of osteoblastic activity (analogous to diagnostic bone tracers such as methylene diphosphonate and hydroxymethylene diphosphonate).  $^{153}\text{Sm}$  emits  $\beta$ -particles (ranging in energy from 640 to 810 keV) and 29% abundant  $\gamma$ -emission with a photopeak of 103 keV; it has a 1.93-d physical half-life (3).  $^{153}\text{Sm}$ -EDTMP is cleared rapidly from the blood with biexponential kinetics; pharmacokinetic studies have suggested that less than 1% of

the injected dose remains in blood by 5 h after injection (3). This rapid clearance occurs as a result of radiopharmaceutical uptake into bone and radiopharmaceutical excretion, which is almost exclusively via urine. Although the absolute quantity of radiopharmaceutical excreted via urine varies inversely with the extent of osseous metastatic disease, urine is felt to represent the only significant route of excretion, with minimal if any excretion occurring via other (hepatobiliary, etc.) routes.

We recently treated a 58-y-old woman with breast cancer metastatic to bone, lymph nodes, and peritoneum with  $^{153}\text{Sm}$ -EDTMP. As a result of peritoneal metastatic disease, the patient developed malignant ascites for which a chronically indwelling peritoneal catheter was placed such that fluid could be drained from the peritoneal cavity at regular intervals for patient comfort. Before treatment with  $^{153}\text{Sm}$ -EDTMP, the question arose as to how much (if any) of the administered radiopharmaceutical dose might localize into the peritoneal fluid and, by corollary, what (if any) radiation safety precautions would be required with respect to the drained peritoneal fluid. Because a review of the literature and package insert failed to answer these questions, we chose to directly assay the fluid itself.

## CASE REPORT

This patient was referred for treatment with  $^{153}\text{Sm}$ -EDTMP by her oncologist. During initial consultation with the nuclear medicine physician on a Friday, the patient disclosed that she had an indwelling peritoneal catheter that was used for intermittent drainage of accumulated peritoneal ascites. Around the time of treatment with  $^{153}\text{Sm}$ -EDTMP, the patient's home health nurse accessed the catheter twice per week (on Tuesdays and Fridays), draining 1–2 L of ascitic fluid each time. Review of imaging studies, laboratory data, and the patient's symptomatology indicated that the patient was an appropriate candidate for  $^{153}\text{Sm}$ -EDTMP therapy, and the decision was made to proceed with treatment the following week. Drainage of peritoneal fluid was performed on a Tuesday afternoon.  $^{153}\text{Sm}$ -EDTMP in a treatment dose of 2.62 GBq (70.7 mCi) was administered intravenously the next day (i.e., on Wednesday afternoon). After injection of the treatment dose, the small amount of residual  $^{153}\text{Sm}$ -EDTMP left in the syringe was washed with

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**TABLE 1**  
Summary of Study Data

Sample (5-mL volume)	Background-corrected counts (CPM)			Mean
	Iteration 1	Iteration 2	Iteration 3	
Ascitic fluid	8,425	8,274	8,194	8,298
Standard	1,832,000	1,823,000	1,830,000	1,828,333

saline and 5 mL of this total volume was transferred to a test tube to serve as a standard for subsequent analysis.

On Friday morning (i.e., approximately 44 h after  $^{153}\text{Sm}$ -EDTMP injection), 1.71 L of peritoneal fluid were drained (using standard, universal precautions) via the patient's indwelling catheter. This fluid was then transported (in a manner compliant with state and federal regulations) to the nuclear medicine laboratory at our medical center for analysis and disposal at approximately 49 h after initial  $^{153}\text{Sm}$ -EDTMP injection. The  $^{153}\text{Sm}$ -EDTMP standard was diluted to an activity of 81.4 kBq (2.2  $\mu\text{Ci}$ ) in a 5-mL volume; this dilution was performed to avoid dead-time loss in the well counter due to a high counting rate, which may invalidate results. After the drained peritoneal fluid was transferred into a large graduated cylinder to measure its total volume, a 5-mL sample was injected into a capped test tube. The sample and the  $^{153}\text{Sm}$ -EDTMP standard (both in a 5-mL volume) were then assayed in a well counter. After a background count was acquired, activity in each sample was measured (each sample was counted in a well counter for 60 s  $\times$  3 iterations). Counts were corrected for background activity and averaged via arithmetic mean.

Study data are summarized in Table 1. Mean background-corrected activity in the 5-mL peritoneal fluid sample was 8,298 cpm, and mean background-corrected activity in the 5-mL/81.4-kBq standard  $^{153}\text{Sm}$ -EDTMP sample was 1,828,333 cpm. The ratio of activity in the peritoneal fluid to that of the standard was 0.454%, thus representing an activity of 369.26 Bq (9.98 nCi) in the 5-mL sample. This represents a total of 126.17 kBq (3.41  $\mu\text{Ci}$ ) in the entire 1.71-L volume of peritoneal fluid on Friday, or 263.07 kBq (7.11  $\mu\text{Ci}$ ) in the entire 1.71-L volume of peritoneal fluid if decay-corrected back to the time of the  $^{153}\text{Sm}$ -EDTMP injection. Thus, the ratio of total activity in the peritoneal fluid relative to the injected  $^{153}\text{Sm}$ -EDTMP dose was approximately 0.01%.

## DISCUSSION

To our knowledge, this represents the first published calculation of  $^{153}\text{Sm}$ -EDTMP accumulation within peritoneal ascites. Our analysis showed that, in this particular patient,  $^{153}\text{Sm}$ -EDTMP accumulation in the peritoneal fluid was minimally above background level and that measured activity in the fluid represented only 0.01% of the injected dose. This is, of course, an isolated case report, and precise numeric values derived from this patient's fluid may not be universally applicable to all patients; however, it would seem unlikely that peritoneal fluid collections in other individuals would significantly differ from what was observed in our patient.

## CONCLUSION

The data in this case study suggest that  $^{153}\text{Sm}$ -EDTMP accumulates only trivially within peritoneal ascites. This information may be useful to the nuclear medicine community since malignant ascites is not an uncommon phenomenon in patients with widely metastatic carcinoma and patients with malignant ascites may be referred for  $^{153}\text{Sm}$ -EDTMP therapy.

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