

# An Injection-Technique Artifact

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*We describe a new artifact relating to improper injection technique: increased localization of radionuclide in an extremity undergoing injection, caused by compression of the extremity in attempts to restrain an individual. The artifact was later simulated by maintaining a tourniquet in place during injection. This is a technical artifact, which is easily preventable. Awareness of the artifact and its cause will prevent false interpretation of such an abnormal localization.*

Artifacts are a common occurrence in nuclear imaging. Because they can simulate pathological lesions and cause problems in interpretation, technologists should be aware of their appearance and etiology. Then preventive measures to eliminate such artifacts and preclude misinterpretation of images can be taken.

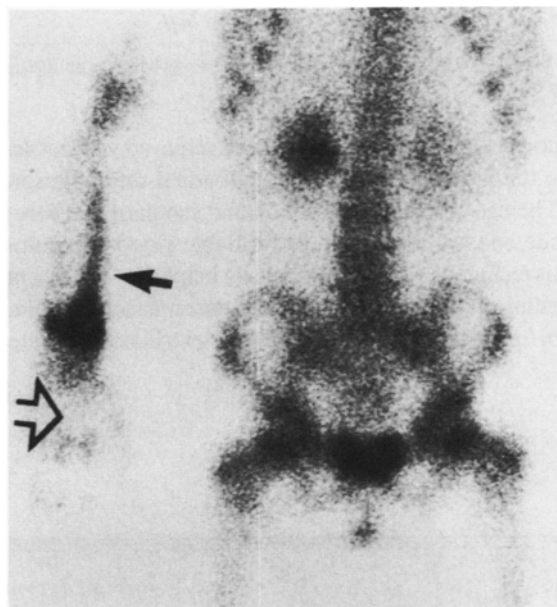
There are three principal types of artifacts in nuclear medicine: they are due to the equipment, the patient, or the technique.

Many artifacts are easily recognized, and most are preventable with good quality control. Occasionally, artifacts may have a subtle appearance and the cause, therefore, is not easily discerned.

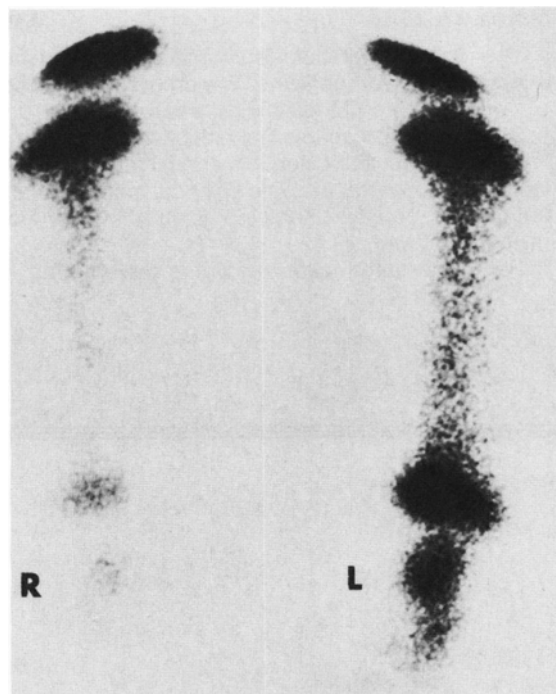
We present an unusual bone scan artifact that is due to injection technique. Its occurrence should be recognized and correctly interpreted. Awareness of it may prevent any future occurrence.

**The Artifact:** A 10-year-old child with rhabdomyosarcoma presented for follow-up bone scan evaluation of his disease. There was no evidence of metastases clinically or on x-rays. The bone image of the right forearm, however, demonstrated prominent localization of the radionuclide in the distal two-thirds of the radius (Fig. 1). The appearance did not suggest the typical localization of metastatic disease and, in view of the child's clinical presentation and follow-up, including negative x-ray of the forearm, the artifact was considered to be due to the technique. It was noted that the intravenous injection had been made into a vein in the dorsum of the hand and that there was no evidence of extravasation during the injection or on the subsequent bone images.

**Determination of the Cause:** The exact mechanisms for localization of the radiopharmaceutical are primarily dependent upon perfusion and metabolism (1). In view of the x-ray and clinical findings in the patient, it seemed unlikely that



**FIG. 1.** Increased localization in distal radius (closed arrow); cause is unknown. Injection site (open arrow) demonstrates no evidence of extravasation.



**FIG. 2.** Decreased localization of bone agent in right extremity, which had restricted blood flow caused by tight bandage.

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**FIG. 3.** Patient's arm is restrained from movement by technologist's tight grip on arm above injection site.

there was a metabolic abnormality particularly related to his primary oncologic disorder. The abnormality was, therefore, considered to be due to altered perfusion. Decreased localization of radionuclide had been observed in a patient with an extremity wrapped tightly with an elastic bandage, which restricted blood flow to the extremity (Fig. 2). The etiology for increased perfusion in our patient was not related to an inflammatory process and, therefore, the method of injection was considered as a possible cause.

Because young children often need to be restrained during the injection (Fig. 3), it was postulated that restraint effectively acts as a tourniquet. This would force high concentrations of the injected radionuclide to perfuse to the bones of the forearm. A similar artifact had been observed on several previous occasions in children with other conditions (Fig. 4). To test this postulate, the situation was simulated simply by leaving a tourniquet in place during radiopharmaceutical injection of a patient referred for a bone scan to evaluate Legg-Perthes disease of the hips. The radiopharmaceutical was injected with the tourniquet intact a few inches above the injection site. The tourniquet was removed immediately after the bone agent and saline "flush" were completely infused and prior to removal of the needle from the vein, in order to eliminate leakage around the injection site. A similar artifact was produced (Fig. 5). The increased localization of radionuclide in the bones of the forearm supported our contention that the artifact was due to compression of the extremity during radiopharmaceutical injection. Subsequently, because of awareness of this problem, the artifact has not reoccurred.

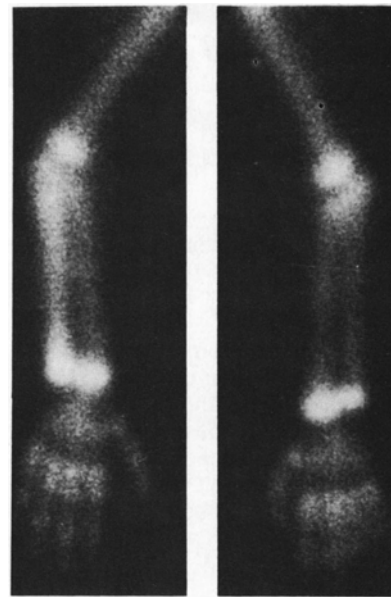
### Discussion

The different artifacts that appear on nuclear images can be related to three major categories: the equipment, the patient, and the technique. Equipment artifacts are often spectacular, occur frequently and often repetitively, and are not correctable. Artifacts due to the patient are often subtle, frequent, and correctable, and are limited to that patient.

The most common cause of artifacts—the technique (injection, imaging, etc.) and the technologist—can produce artifacts that are both subtle and spectacular, frequent and nonrepeti-



**FIG. 4.** Image of patient with soft tissue mass of the right forearm shows increased localization in distal right tibia not related to disease or complaint. Injection site was dorsum of right foot.



**FIG. 5.** Image of both forearms demonstrates increased bone localization of radiopharmaceutical, which was injected in left hand while tourniquet pressure was applied.

tive, and easiest of all to prevent. This example—increased bone localization at the injection site caused by tourniquet compression of an extremity during injection—is such an artifact. The general adage, "Do not inject a radiopharmaceutical into an area of clinical abnormality," is an excellent rule, but in generalized conditions, such as oncologic disorders or inflammatory processes, the artifact produced by compression during injection still produces a perplexing and difficult interpretative problem. An awareness of its cause—particularly the elimination of forcible compression restraint of a struggling child during injection—will easily prevent its occurrence. The opposite finding, that is, decreased localization of radionuclide

in an extremity, can also occur due to tight elastic stockings or elastic bandage wrappings. This becomes particularly prominent in patients with edema of an extremity, which in itself can cause ischemic conditions.

## Reference

1. Subramanian G, McAfee JG, Thomas FD, et al. New diphosphonate compounds for skeletal imaging: Comparison with methylene diphosphonate. *Radiology* 1983;149:823-28.