SHORT COMMUNICATION

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Revisiting body contour outlining procedures in nuclear medicine

Warda Ahmad[1*], Nayyar Rubab[1], Farkhanda Gillani[1], Muhammad Shahzad Afzal[1], Muhammad Babar Imran[1]

ABSTRACT

Obtaining clear localization images in nuclear medicine can be challenging when radiotracers are administered locally. This lack of anatomical information can make it difficult to relate the scintigraphic findings to specific body structures. Various localization techniques such as point source, cobalt wires, transmission scans using Cobalt-57 (^{57}Co) and Gadolinium-153 (^{153}Gd), and hybrid imaging (single photon emission computed tomography) can be employed to overcome this issue. The primary goal of this communication is to summarize the available body contour outlining methods in nuclear medicine and provide a comprehensive guide for nuclear medicine trainees to obtain high-quality localization images that can facilitate the better evaluation of nuclear medicine scans.

Keywords: Localization techniques, nuclear medicine, SPECT-CT.

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Correspondence to: Warda Ahmad
*Senior Medical Officer, Department of Nuclear Medicine, Punjab Institute of Nuclear Medicine (PINUM), Faisalabad, Pakistan.
Email: Wikolia16@outlook.com
Full list of author information is available at the end of the article.

Delineating body habitus in nuclear medicine can be challenging in cases where radiotracers are administered locally, e.g., via subcutaneous, intradermal, or interstitial injections. This is often the case in lymphoscintigraphy for sentinel lymph node identification and cerebrospinal fluid (CSF) shunt evaluation, where localized imaging of the injection site and surrounding regions is performed. In general, in nuclear medicine imaging, where intravenous administration of radiotracers is used, blood pool and organs are appreciable which can help in delineating body anatomy. However, when radiotracers are injected locally, the lack of anatomical information in the resulting images can make it difficult to relate the scintigraphic findings to specific body structures [1].

While various techniques have been documented in the literature to outline the body for the purpose of localization, these methods are not commonly used in clinical practice, leading to a decrease in knowledge of body contour outlining among training doctors. The objective of this communication is to summarize all these methods and provide a guide for nuclear medicine trainees on how to obtain optimal localization images for better evaluation of nuclear medicine scans.

There are several methods that can be used to outline the body for localization purposes. One method is to move a point source or a small amount of ^{99m}Tc-pertechnetate activity in a syringe along the outer margins of the patient's body during the acquisition of planar scintigraphic images [2]. Another technique is to use one or two cobalt wires to create a body silhouette by placing them along the outer margins of the patient's body [3]. A transmission scan using Cobalt-57 (^{57}Co) or Gadolinium-153 (^{153}Gd) flood source can also effectively provide body landmarks with low patient dose exposure compared to a computerized tomography (CT) scan. Additionally, outlining body contour using a ^{153}Gd line source on a dual head gamma camera, in which the source is attached to one camera head and using the other detector concurrently acquiring the ^{99m}Tc emission images and ^{153}Gd localization images, can be useful. Currently, hybrid imaging using single photon emission computed tomography (SPECT-CT) is often performed for localization, if available. It provides more accurate and three-dimensional anatomical details than the aforementioned outlining methods but has longer imaging time and increased radiation exposure due to the CT scan and may not always be easily accessible. Using ^{99m}Tc-pertechnetate point sources and ^{57}Co flood sources, which are readily available for gamma camera quality control procedures, can facilitate the outlining of body landmarks in lymphoscintigraphy and CSF shunt evaluation [2].

We, hereby, describe the method to obtain a transmission scan using ^{57}Co flood source and localizing injection

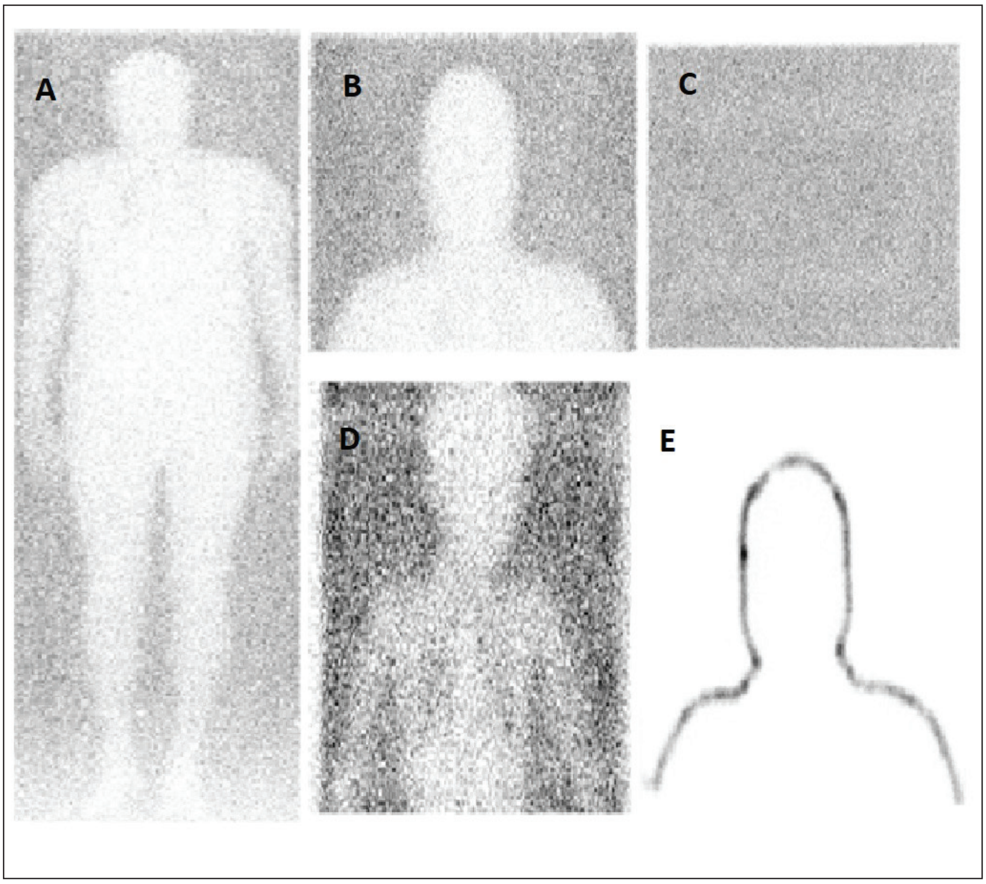

Figure 1. *Body contour outlining methods in nuclear medicine. Panel (A) shows whole body transmission scan using ^{57}Co flood source. Panel (B) demonstrates transmission scan of head and neck region while panel (C) presents an image from detector on which source was placed in this case. Panel (D) shows transmission scan of a child with faint visualization of bilateral lung fields. Panel (E) illustrates a method for outlining the body contours using a point source ^{99m}Tc-pertechnetate.*

site using point source. Figure 1A illustrates the whole-body transmission scan performed on a dual detector gamma camera (Infinia Discovery NM/ CT 670 Pro) using an available ^{57}Co flood source (Epsilon radioactive sources) with an activity of 69.61 MBq at the time of the study (555 MBq at reference date). The scan was acquired using low-energy high-resolution collimators, a matrix size of 1,024 × 256, a zoom of 0.92, and an exposure time of 100 seconds per pixel. The ^{57}Co flood source was placed underneath the patient's table on detector 2, and a transmission scan was obtained through detector 1 (detectors in H-mode). The ^{57}Co flood source clearly demarcated the body outline due to attenuation by the patient's body. Figure 1B shows the transmission image of the head and neck region which was acquired using the same procedure as above (matrix size 256 × 256, acquisition time of 1 minute). However, it should be kept in mind that no anatomical information will be obtained from the detector on which source is placed due to high counts from ^{57}Co flood source (posterior view from detector 2 in this case) as shown in Figure 1C.

Interestingly, a transmission scan of a child (Figure 1D) showed the incidental visualization of the bilateral lung fields, likely due to the child's smaller body surface area, which resulted in reduced attenuation. It is important to mention here that we used a decayed flood source for transmission scans to minimize unnecessary radiation exposure to the subjects. Moreover, the effective radiation dose from external flood sources, as reported in the literature, is very low (0.02 mSv) as compared to a CT scan (approximately 3 mSv). Figure 1E shows a method for outlining the body habitus using a point source of ^{99m}Tc-pertechnetate. The body was outlined by slowly moving the point source (with an activity of 18.5 MBq or 500 µCi), held in one hand, along the outer margins of the patient's body from one end to the other (using a matrix size of 256 × 256 and acquisition time of approximately 1 minute).

Defining the patient's body outline helps with anatomical localization and leads to better interpretation of scans. Having this knowledge can be crucial for nuclear medicine trainees, especially in situations where resources are limited and SPECT-CT is not available. Additionally, transmission scans can be performed using a low-energy flood source, which can minimize the patient's radiation exposure. This makes them a useful and safe method for evaluating body habitus in nuclear medicine.

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List of Abbreviations

Co-57	Cobalt-57
CSF	Cerebrospinal fluid
Gd-153	Gadolinium-153
MBq	MegaBecquerel
SPECT-CT	Single photon emission computed tomography

Competing interests

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Consent for publication

Not required.

Consent of patient

Informed consent was obtained from patient.

Authors' contributions

WA was a major contributor in writing this manuscript. NR and FG provided valuable assistance in the writing process. MSA and MBI offered critical feedback and insights throughout the writing process.

Availability of data and materials

Not applicable.

Author details

Warda Ahmad[1], Nayyar Rubab[1], Farkhanda Gillani[1], Muhammad Shahzad Afzal[1], Muhammad Babar Imran[1]

1. Department of Nuclear Medicine, PINUM Cancer Hospital, Faisalabad, Pakistan

References

1. DiFilippo FP, Brunken RC, Neumann DR. Transmission imaging in lymphoscintigraphy with a 153Gd flood source. J Nucl Med Technol. 2015 Dec;43(4):253–60. https://doi.org/10.2967/jnmt.115.161935
2. Mar MV, Dickinson RL, Erwin WD, Wendt RE 3rd. Optimal (57)Co flood source activity and acquisition time for lymphoscintigraphy localization images. J Nucl Med Technol. 2008 Jun;36(2):82–7. https://doi.org/10.2967/jnmt.107.047043
3. Erba PA, Sollini M, Boni R. Lymphoscintigraphy for the differential diagnosis of peripheral edema and intracavitary lymph effusion. In: Mariani G, Manca G, Orsini F, Vidal-Sicart S, Olmos RAV, editors. Atlas of lymphoscintigraphy and sentinel node mapping. Milano, Italy: Springer; 2013. pp 50–1. https://doi.org/10.1007/978-88-470-2766-4_5