Lymphoscintigraphy

OVERVIEW

- Lymphoscintigraphy refers to the scintigraphic visualization of lymphatic drainage of a specific body site following intradermal injection of a radiolabeled colloid.
- It is a valuable procedure for guiding the surgeon in locating the drainage pathways in patients with breast cancer or melanoma and identifying the sentinel node.
- There are optimal preparation techniques for making Ultrafiltered Tc-99m sulfur colloid. It is important to explain the rationale for using this technique.
- It is important to identify the ideal particle size for colloid particles to insure rapid migration in the lymphatics.
- There are optimal injection techniques for injecting different categories of patients

SUMMARY

- Filtered Tc-99m SC suitable for performing high quality lymphoscintigraphy studies can be easily prepared.
- This preparation can be performed in any laboratory with readily available materials and equipment. Capital equipment investment is $100 for dedicated microwave oven.
- Clinical results using the double-filtered Tc-99m SC compares very favorably with studies performed with other nanocolloid preparations
- This easily prepared radiopharmaceutical enables every Nuclear Medicine Department to offer lymphoscintigraphy at minimal cost to surgeons and clinicians.
- Sentinel Lymph node mapping can decrease surgical time and post-surgical morbidity.
- Lymphoscintigraphy provides a simple, rapid method for finding the sentinel lymph Node(s)

LYMPHOSCINTIGRAPHY: WHY DO IT?

● Due to anomalous drainage patterns, it is impossible to simply look at a patient and know drainage patterns. Lymphoscintigraphy guides the surgeon to the primary lymph nodes draining the area around the lesion, allowing biopsy of appropriate nodes.

● Decreasing surgical time and sampling fewer lymph nodes results in fewer post-surgical complications and morbidity.

How does it work?

● 4-7 bubbles of Tc-99m ultrafiltered colloid are injected intradermally around periphery of the lesion. Each bubble contains ~ 100 μCi in 100 ml, equivalent to 1 μCi/ml. The colloid begins to migrate very quickly following the injection

Lymphoscintigraphy: Techniques

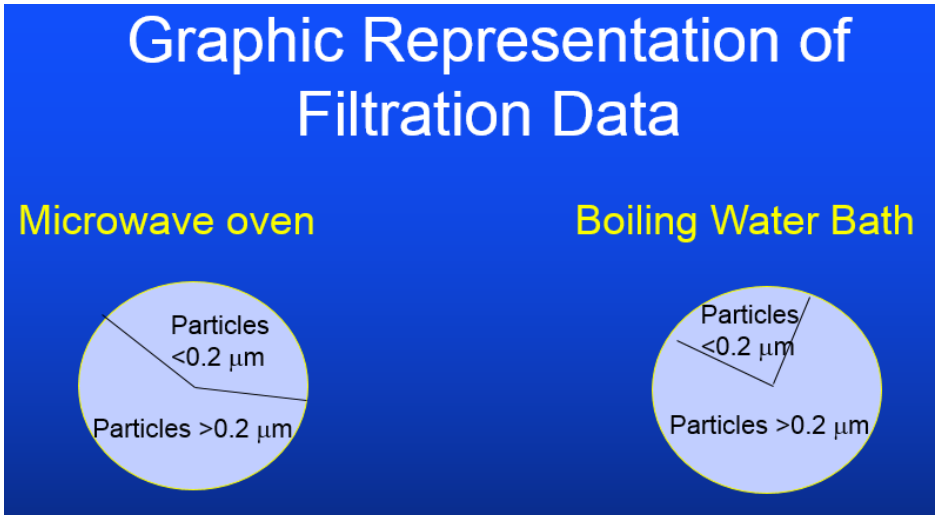
Successful lymphoscintigraphy requires only the very smallest colloid particles (<0.2 μm). Unfiltered Tc-99m SC prepared by conventional methods results in unfavorable particle distribution- most particles are in range of 0.5-2.0μm.

Preparation Methods

- boiling water bath for 5-10 min
- microwave oven for 15-30 sec
- room temperature incubation for 1 hr

Particle Size as f (Preparation Method)

- boiling water bath: mostly larger particles
- microwave oven: wide range of particles, many small
- room temperature incubation for 1 hr: mostly larger particles

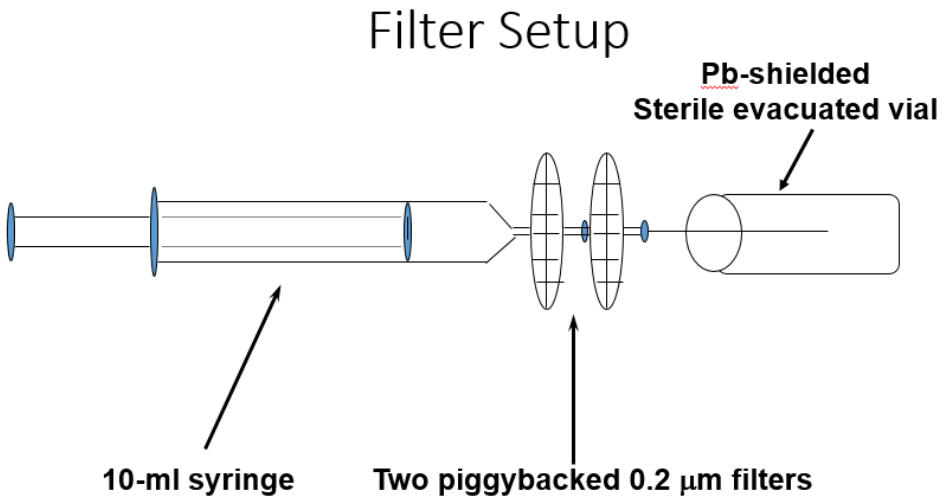


General Preparation Method of Filtered Tc-99m SC

- Reaction mixture heated in microwave oven with 28 sec heating cycle at 1/2 power (275 watts) OR in boiling water bath with 5 min heating cycle at 100°C
- Reaction mixture buffered, cooled 5-10 min.
- Tc-99m SC drawn into 10 ml syringe and filtered through two piggybacked 0.2 μm terminal filters into a sterile evacuated vial.

Removal of Large Particles

- Preferred method: Terminal filtration through a 0.2 μm disposable filter. Manufacturers: Burron Medical, Gelman, Millipore
- filtration step is repeated to remove particles missed by first filtration



Optimal Parameters for Routine Preparation for Tc-99m SC

- In microwave oven, RCP>98% routinely obtained with 28 sec heating cycle at 1/2 power (275 watts)
- In boiling water bath, RCP> 98% routinely obtained with 5 min heating cycle at 100°C

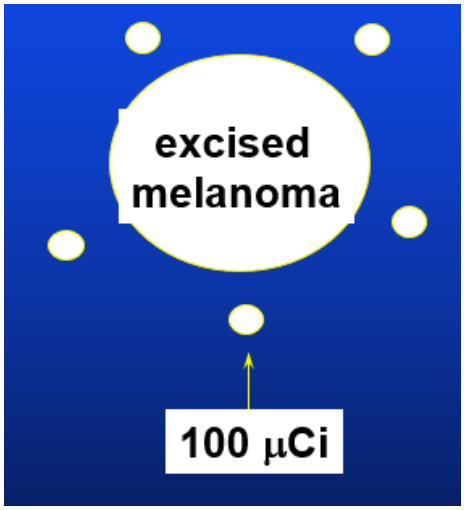
Optimal Preparation of 99mTc-SC for Lymphoscintigraphy

- Microwave 5 ml of reaction mixture containing 25 mCi $^{99m}TcO_4^{1-}$ for 28 sec at 1/2 power (275 watts)
- Add 1 ml of buffer, then cool for 5-10 minutes
- Draw Tc-99m SC into 10 ml syringe
- Filter through two 0.2 µm filters (piggy-backed) into sterile evacuated vial

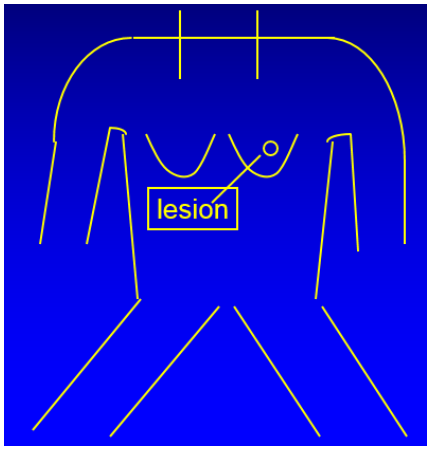
Lymphoscintigraphy: Most common indications for Lymphoscintigraphy:

- Primarily for melanoma and breast cancer
- Provides a lymphatic drainage map
- Permits sentinel node detection
- Does NOT detect tumor invasion
- Probe detector useful

Lymphoscintigraphy of Malignant Melanoma: injection sites



Lymphoscintigraphy of Breast Carcinoma



Deep vs Intradermal Injection

- Intradermal may be more painful
- More failures with deep
- Deep may show internal nodes better

Sentinel Lymph Node Detection

- Requires use of intraoperative probe
- Can reduce OR time
- May help to stage cancer patients
- May reduce unnecessary surgery
- May reduce morbidity

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