Sentinel lymph node biopsy (SLNB) has been the standard of care for the assessment of lymph node metastases in breast cancer patients since the 1990s.1 Sentinel lymph node mapping is a technique in which the region surrounding a patient’s primary breast tumor is injected with a traceable blue dye (e.g., isosulfan blue) and/or a radioisotope (e.g., technetium-labeled sulfur colloid). The tracer then travels through the lymphatic system to the regional lymph node basin to identify the first tumor-draining lymph node(s), the sentinel node(s). Sentinel nodes are identified using a probe to detect the radioactive tracer within the node and/or by direct visualization of a blue sentinel node through a small surgical incision.2

The identification, excision, and pathologic assessment of the sentinel node(s), which together is called a SLNB, is a commonly performed surgical procedure that has been shown to be highly effective in detecting micrometastatic disease in breast cancer patients.2 Patients whose nodes test negative for disease or have minimal metastatic disease can be spared a complete axillary node dissection.3

While SLNB has been shown to reduce the likelihood of lymphedema compared with axillary lymph node dissection, SLNB does not completely eliminate the risk of lymphedema.4-11 An evaluation of lymphedema studies from 2000 to 2007 revealed that 253 (about 6%) of 4,241 patients who had undergone SLNB subsequently developed lymphedema.4-11 With an estimated 207,090 cases of breast cancer diagnosed in 2010 and 20% to 30% of these patients requiring SLNB, as many as 3,700 could develop lymphedema.

Axillary reverse mapping (ARM) was recently introduced as a procedure for identifying upper extremity lymphatics so surgeons can preserve them at the time of axillary lymph node dissection or SLNB in order to potentially reduce the risk of postsurgical lymphedema.13-15 During ARM, blue dye is injected in the ipsilateral (same side) upper inner arm along the intramuscular groove,16 travels in the lymphatics to the axilla, and serves to identify the lymphatic channels of the arm. It is believed that the identification of the upper extremity lymph nodes is possible because of the anatomic variation of the lymphatics of the upper extremity and breast.13 The ARM procedure was first evaluated by Klimberg et al.; during this evaluation, an initial group of 18 patients underwent the ARM procedure with the injection of 2.5 to 5.0 mL of isosulfan blue dye in the upper inner arm at the time of axillary lymph node dissection.14 In a subsequent group of patients undergoing SLNB, with radioactive tracer used to inject the tumor site and blue dye used to identify ARM nodes, only 3% of blue nodes contained radioactive tracer (from SLNB)17 and metastases were not detected in any of the blue ARM nodes. This is important because tumor involved nodes should not be left behind during the SLNB staging procedure even if they are demonstrated to also drain lymphatics from the upper extremity.

However, while the feasibility of the ARM procedure has been demonstrated in several small studies,1, 14, 16, 18, 19 the efficacy of ARM and its reduction of the incidence of lymphedema have yet to be confirmed. More recent ARM studies have reported the identification of metastatic disease in up to 18% of the blue (ARM) lymph nodes which if preserved may lead to disease progression.18, 20 These results call into question the oncologic safety of the ARM technique. Studies evaluating ARM at the time of SLNB have had similar findings; a concordance between SLNB radioactive lymph nodes and ARM blue nodes of 18.9%, with one-third of those nodes containing metastases.21 Most studies report that ARM can identify lymphatics and nodes in 60% to 88% of patients. Other studies indicate that despite the identification of the nodes and/or lymphatics by ARM, it is not always possible to preserve these lymphatics.22 An additional problem with the technique is that some patients have reported temporary blue tattooing of the injection site, which has lasted from a few days to several months.16 Most importantly, the ARM technique has not been longitudinally studied with objective extremity measures; therefore the primary...
ARM-related benefit associated with a proposed reduction in the incidence of lymphedema has yet to be determined.\(^{18}\)

For patients with breast cancer, SLNB has been shown to be a highly accurate staging procedure that reduces but does not eliminate the risk of lymphedema compared with axillary node dissection. However, given the annual incidence of breast cancer and the frequency with which SLNB is performed, even a small risk translates into thousands of women developing lymphoedema. These figures have prompted clinicians to investigate additional techniques such as the ARM procedure for lymphatic preservation.\(^{14}\)

Although there is not sufficient evidence for the widespread adoption of ARM, further study is warranted to determine its safety, efficacy, and long-term benefits.