

Detection of sentinel lymph node using magnetic nanoparticles

Tomáš Eckschlager^a

^a Dept. paediatric haematology oncology, 2nd Medical Faculty, Charles Univeristy and University Hospital Motol, Prague

There was developed further application of nanotechnology- detection of sentinel lymph node by magnetic nanoparticles. Sentinel lymph node biopsy is the standard surgical procedure for the axilla in early node-negative breast cancer. If no cancer is detected in the sentinel lymph node, there is no need for an axillary lymph node dissection in which usually 30 or so lymph nodes are removed. Axillary node dissection is often complicated by arm lymphedema. Moreover sentinel lymph node biopsy procedure results in shorter breast cancer operations and better patient recovery compared to node dissection.

To date is used radioisotope Tc99 and/or blue dye to localize the sentinel lymph node. Sienna+[®] is a tracer capable of an induced magnetic response and was developed for use with the SentiMag[®] instrument. Instrument generates alternating magnetic field which temporarily magnetizes iron oxide in Sienna+[®] particles and the magnetic signature generated by those particles is then detected by the probe. Sienna+[®] is an aqueous suspension of organically coated, superparamagnetic iron oxide particles. It is injected subcutaneously where the natural physical action of the lymph nodes filters out the particles, enabling the sentinel nodes to be located with the SentiMag[®]. The system was developed by Endomagnetics Limited, Cambridge, UK.

Optimum localisation agents should remain fixed at the sentinel nodes and do not travel to other nodes. This depends on particle size, for ideal localisation, agents should have a particle diameter 20 - 100 nm. Routinely used Tc99 Nanocoll has particles 4-100 nm. Sienna+[®] was designed with a tight distribution around 60 nm.

Clinical prospective, multicentric and multinational study which included 150 breast cancer patients per arm showed that magnetic sentinel lymph node localization can be performed easily, safely and equivalently well in comparison to the radiotracer method.

Advantages of Sienna+[®] are: simple storage and handling procedure, and significantly improved workflow compared with radioactive tracers, localisation can start after only 20 mins following injection, dark colour eliminates requirement for separate dye injections, and long shelf life.

This work was financially supported by project NANOLABSYS CZ.1.07/2.3.00/20.0148 is highly acknowledged.

The authors declare they have no potential conflicts of interests concerning drugs, products, services or another research outputs in this study.

The Editorial Board declares that the manuscript met the ICMJE „uniform requirements“ for biomedical papers.

References

1. Douek M, Klaase J, Monypenny I, Kothari A, Zechmeister K, Brown D, Wyld L, Drew P, Garmo H, Agbaje O, Pankhurst Q, Anninga B, Grootendorst M, Ten Haken B, Hall-Craggs MA, Purushotham A, Pinder S; SentiMAG Trialists Group. Sentinel node biopsy using a magnetic tracer versus standard technique: the SentiMAG Multicentre Trial. *Ann Surg Oncol.* 2014;21(4):1237-45
2. Thill M, Kurylcio A, Welter R, van Haasteren V, Grosse B, Berclaz G, Polkowski W, Hauser N. The Central-European SentiMag study: sentinel lymph node biopsy with superparamagnetic iron oxide (SPIO) vs. radioisotope. *Breast.* 2014;23(2):175-9



This licence allows users to download and share the article for non-commercial purposes, so long as the article is reproduced in the whole without changes, and the original authorship is acknowledged.