AbstractID: 6662 Title: Image deconvolution in autoradiography: a preliminary study

Purpose: To improve the image contrast and resolution of phosphor imaging plate based digital autoradiography (DAR) through a deconvolution algorithm.

Method and Materials: The study was conducted with Fuji BAS-MS2325 phosphor imaging plates. Series of small radioactive sources, typically 100-200 microns in diameter, were constructed on a hydrophobic surface of glass micro slides for different radioactive iodines. The DAR images of these test sources are analyzed using the Richardson-Lucy (R-L) deconvolution algorithm to derive the point spread function (PSF) of the radionuclides on the imaging plate. DAR image recovery is performed with the R-L algorithm using measured PSF. The performance of this methodology is evaluated with a sham DAR image, and demonstrated on actual tumor sections containing radiotracers.

Results: The measured PSF shows satisfactory reproducibility for each radionuclide, and can be represented by the sum of three 2-D Gaussian peaks. Simulations suggest that within a wide range of signal noise ratio (SNR), the deconvolution algorithm can closely recover the radioactivity distributions on tissue sections. In addition, there exists optimal R-L iteration numbers for different SNR levels in terms of the correlation of radioactivity distribution and restored image intensity. In the reconstructed images of tumor sections, the contrast and details are remarkably improved.

Conclusion: Deconvolution improves image contrast and detail but amplifies noise. The usefulness of image deconvolution lies in the removal of false-positive pixels and achieving a better defined map of the radioactivity distribution within the tissue section, allowing for quantitative analysis of marker distribution at the loco-regional level. Our method does not require sophisticated instrument, and can be conveniently conducted in laboratory equipped with ordinary DAR and microscopy devices.