Purpose:

To date, 13 robotic brachytherapy systems have been developed incorporating a variety of imaging, control, and delivery techniques. The joint AAPM/ESTRO TG-192 report presents a new protocol for the validation of brachytherapy robotic systems and a review of the various brachytherapy systems. This study examines spatial positioning accuracy of implanted seeds.

Methods:

A recommendation is that a uniform test protocol should be followed for evaluating performance of any robotic systems that would be used for brachytherapy, especially for radioactive source implantation. Parameters needed to be evaluated are needle tip positioning accuracy, needle tip positioning repeatability, positioning accuracy of the delivered sources, robot-to-imager calibration accuracy, and qualitative assessment of tissue damage if needle rotation is used. To accomplish these goals, a phantom (polyvinylchloride) mimicking soft tissue is recommended. For the validation study, phantoms were prepared at Thomas Jefferson University and then sent to participating institutes to ensure phantom consistency and quality. A treatment plan was developed with needle and seed coordinates. Participating institutes would deposit 100 dummy seeds in the phantom using their robotic system. Five seeds would be deposited along each needle at inter-seed spacing of 10mm; needles would be arranged in a specified order in a 10mmx10mm grid. Upon completion of seed deposition, the phantoms would be imaged using CT and fluoroscopy and/or digital photography. An example test run and observed accuracies are presented.

Results:

Observations so far from two robotic brachytherapy systems indicate that the protocol is feasible and easy to implement. Robotic systems following this protocol can deposit seeds within 1mm (3D) of the intended location.

Conclusions:

The TG-192 protocol will be useful for commissioning any robotic brachytherapy seed-implantation system. Use of this standardized method will allow quantitative comparisons of seed deposition positioning accuracies obtained from any robotic brachytherapy system.