Purpose: To establish device-specific daily quality assurance procedure for image-guided brachytherapy robotic system. To recommend sufficient tests and tolerance levels which would be acceptable for readily identifying and localizing possible deviations from normal system functionalities.

Methods: Image-guided brachytherapy robot consists of three mutually paired functional modules: robotic hardware with sensors, control and planning software, and image acquisition subsystem. Therefore, daily QA procedure should ensure mechanical and software functionality, appropriate system calibration, clinical image acquisition and quality, and verification of system accuracy. Recommended daily QA tests can be summarized into three basic groups: mechanical screening, robotic system functionality, and overall calibration test. Mechanical screening test includes visual check of connectors, controllers, wires, sensors and motors, connectivity test for controllers, motors, encoders and moving parts, sensors readings and sensitivity, and emergency subsystem functionality test, such as emergency button or manual takeover check. Robotic system functionality test incorporates automatic hardware detection and mobility of moving parts, such as probe stage, gantry and insertion mechanism. It also includes image upload and acquisition test. Purpose of overall calibration test is to simulate seed placement into predefined position using captured image sets. Specially designed tool with three markers should be attached to the robot. Tip of each marker has different coordinates. System should drive needle, touch and stop next to each marker. Difference between needle and marker tip should be recorded.

Results: First and the second groups of tests are designed to have pass/fail outcome. Tolerance values for third test are ±0.5mm. Daily QA procedure was developed to minimize test time which is 20min on average.

Conclusions: Routine daily QA procedure plays crucial role in ensuring overall safety of brachytherapy robotic system for clinical implementation. Recommended procedures are intended to support and supplement development of comprehensive brachytherapy robotic QA program.

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