Purpose To demonstrate the feasibility and usefulness of a real time intraoperative planning system with advanced optimization for prostate seed implantation.
Materials and methods We have developed and implemented a method for real-time optimized planning of prostate seed implantation in the operating room (OR), based on the genetic algorithm (GA) driven Prostate Implant Planning Engine for Radiotherapy (PIPER). An integrated treatment planning system was designed and built, which includes real-time ultrasound image acquisition, treatment volume segmentation, GA optimization, real-time decision making and sensitivity analysis, isodose and DVH evaluation, and virtual reality navigation and surgical guidance. Ten consecutive patients previously scheduled for implantation were included in the clinical study.
Results The feasibility of the system was established by careful monitoring of each step in the OR and comparison with conventional preplanned implants. The median elapsed time for complete image capture, segmentation, GA optimization and plan evaluation was 4.5, 10, 1.6 and 2 minutes, respectively. The quality of the OR-based plans was shown to be equivalent to the corresponding preplans via detailed dosimetric comparison. The perceived usefulness was established through a questionnaire survey completed by each participating clinician in the procedure. The time-saving and process-streamlining potential of the new technique is discussed.
Conclusion An intraoperative optimized planning system for prostate brachytherapy was developed. The feasibility and utility of the system was established through a controlled clinical study.
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