ULTRASOUND AS A QUANTITATIVE IMAGE GUIDED MODALITY IN RADIOTHERAPY

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US GUIDANCE RT WORKFLOW

Feedback loop

System type

Simulation Preparation Treatment
CLINICAL APPLICATIONS

- PROSTATE
- BREAST
- OTHER SITES:
  1. LIVER
  2. GALLBLADDER
  3. PANCREAS
  4. BLADDER
  5. H&N
  6. . . .

QUANTITATIVE

- LOCALIZATION
- VOLUME MEASUREMENT
- MOTION TRACKING

LOCALIZATION

Berrang et al (2009)
13.1 ml larger in CT scans on average.

Comparison of prostate volume measurements between MRI and CT techniques and methods.

Journal of Medical Imaging and Radiation Oncology. 58():327, Sep 2014
K. Taylor, S. Constantine

Up to 9% error in volume estimate.

Fontanarosa et al., MedPhys 39, 2012
WHAT PREVENTS QUANTITATIVE USE OF US?

- OPERATOR DEPENDENCE
- PROBE PRESSURE EFFECT
- IMAGE QUALITY
- ABERRATIONS
- US SPECIFIC WORKFLOWS
  - ...
  - NOT BEING AWARE OF WHAT WE ARE DOING...

OPERATOR DEPENDENCE

It is THE major (perceived) reason why US guidance is not as widespread as it deserves.
Maximum reported prostate displacements due to probe pressure:

- up to 5 mm under normal conditions
- up to 10 mm when high pressure is applied
In general it is difficult to have consistent image quality.

1) Select your probe well
2) Decide what (possibly mixed) flavor of dimensions you want to use.

Automate US imaging operations:
- Contouring
- Probe positioning
- Image interpretation
- Use of information
- ...
Note: Spatially corresponding slices of the US volume
Note: Spatially corresponding axial slices of the CT volume

(A) CT scanner
(B) Skin markers on the patient's body for isocenter laser alignment;
(C) Kneefix™ 2;
(D) Feetfix™ 2;
(E) EpiQ7 US system monitor;
(F) Mechanical arm with rotary knob for US probe fixation.
OUR SETUP

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Questions?