Current prevalence and uses of SGRT in the US

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RETHINKING MEDICAL PHYSICS

Disclosures

- Financial – None
- Member of the TG-302: Surface Guided Radiotherapy

Overview

- Survey on SGRT
  - Overview
  - Highlight of results
- Use of SGRT for SBRT
  - Initial setup
  - Intrafraction monitoring
  - DIBH

Disclaimer

Short talk – for more in-depth info, refer to references

Survey: SGRT use in RO

Aim: Assess current status of SGRT in the US

1. Availability/commissioning
2. Clinical uses of surface imaging

Audience: All full members of AAPM (therapy/other)

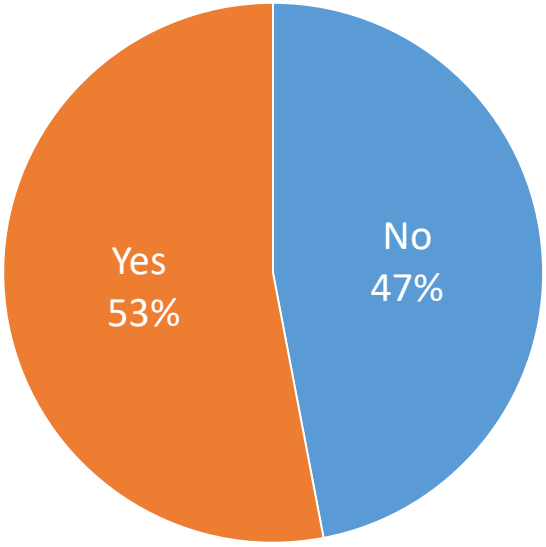
Data collection date: 2018

Response rate: 14%

1- Padilla et al, JACMP, 2019

Anonymous survey designed to assess the extent of use of SI for RT in the US and gain more insight on its implementation in the field. Questions crafted to inquire about availability of this technology in clinics, existing commissioning procedures, and its role in current clinical practice regarding both its applications and common treatment sites of use.

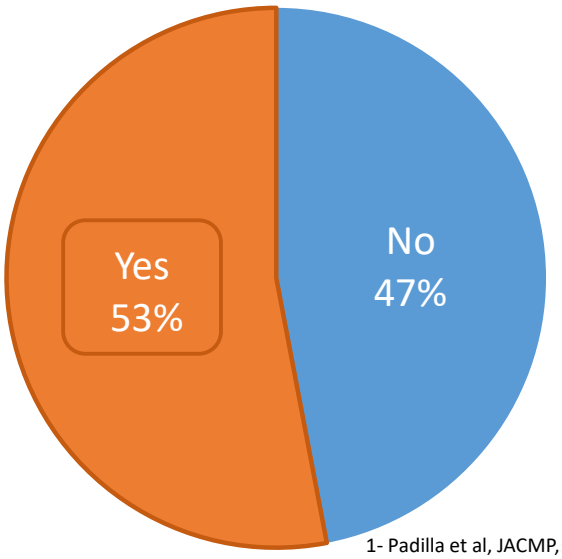
Survey results - Surface Imaging System Installed?



1- Padilla et al, JACMP, 2019

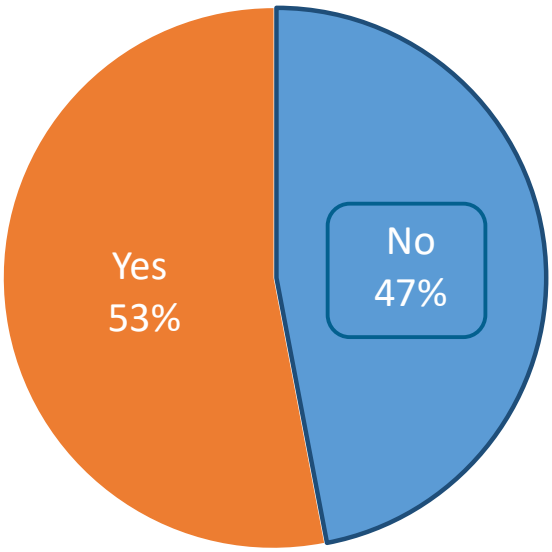
Survey results - Surface Imaging System Installed?

- 59% reported installation on or after 2015
- 11% reported not using it clinically



1- Padilla et al, JACMP, 2019

Survey results - Surface Imaging System Installed?



- 49% planned to purchase in 1-3years

1- Padilla et al, JACMP, 2019

Survey results – commissioning

- 37% used vendor guidelines only
- 49% used multiple references

- 74% performed end-to-end test

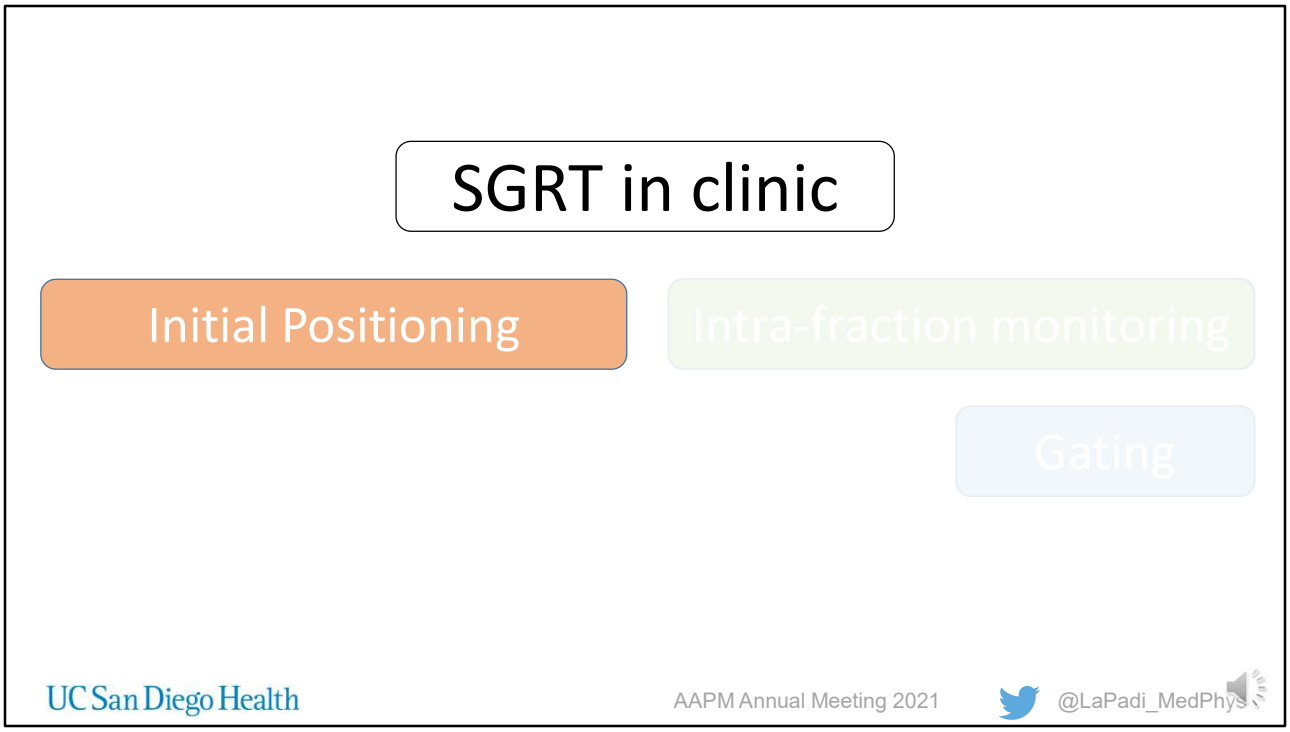
1- Padilla et al, JACMP, 2019

SGRT in clinic

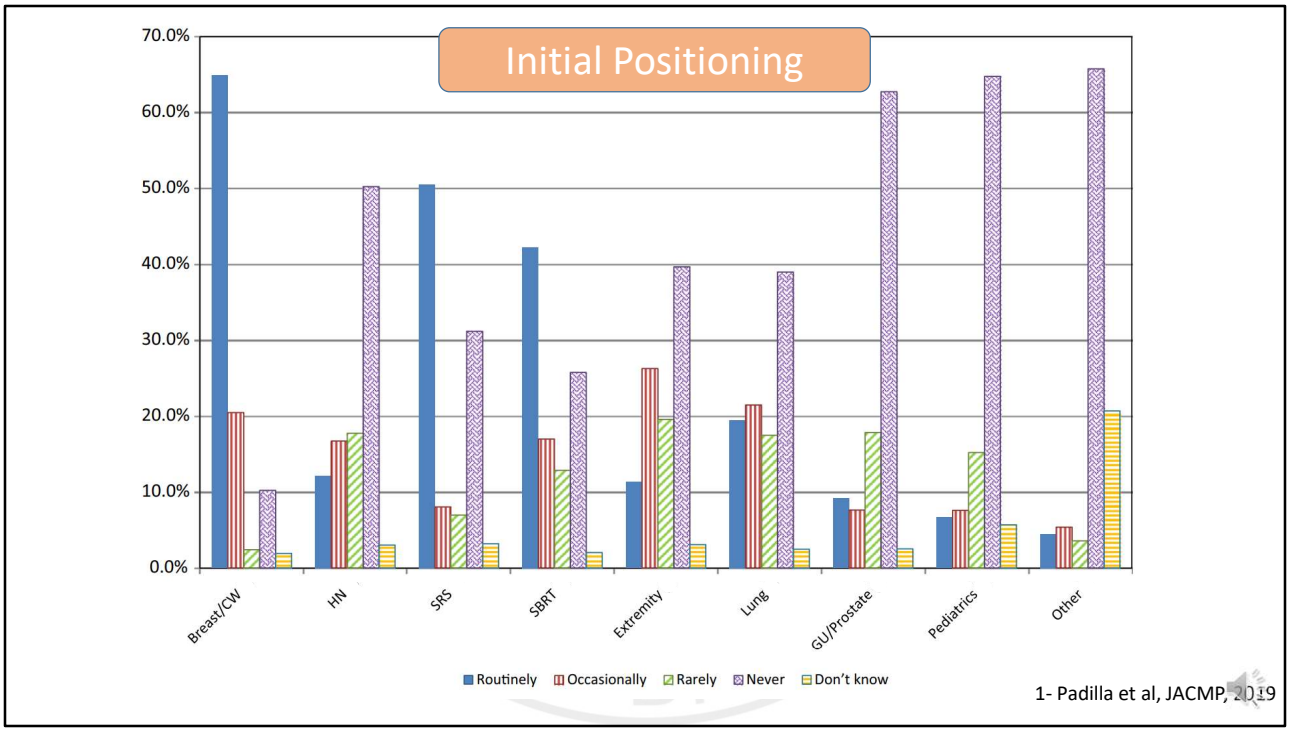
Initial Positioning

Intra-fraction monitoring

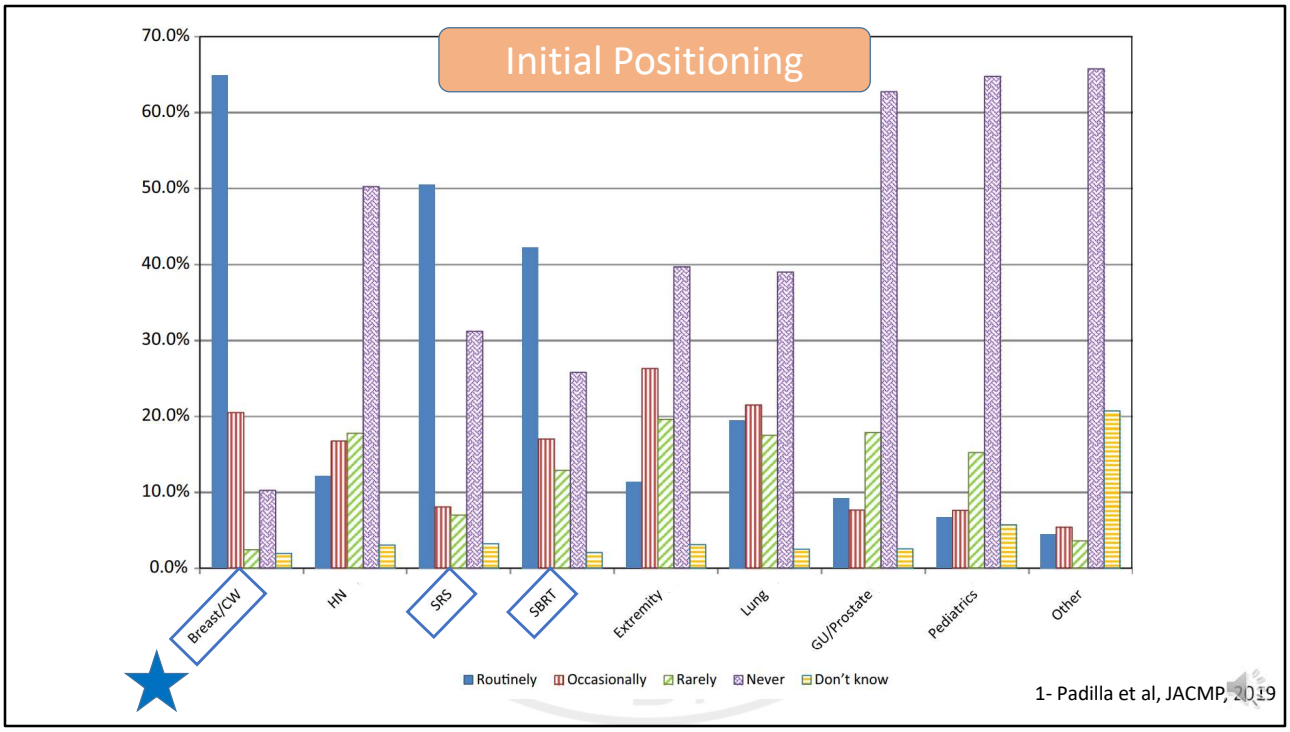
Gating



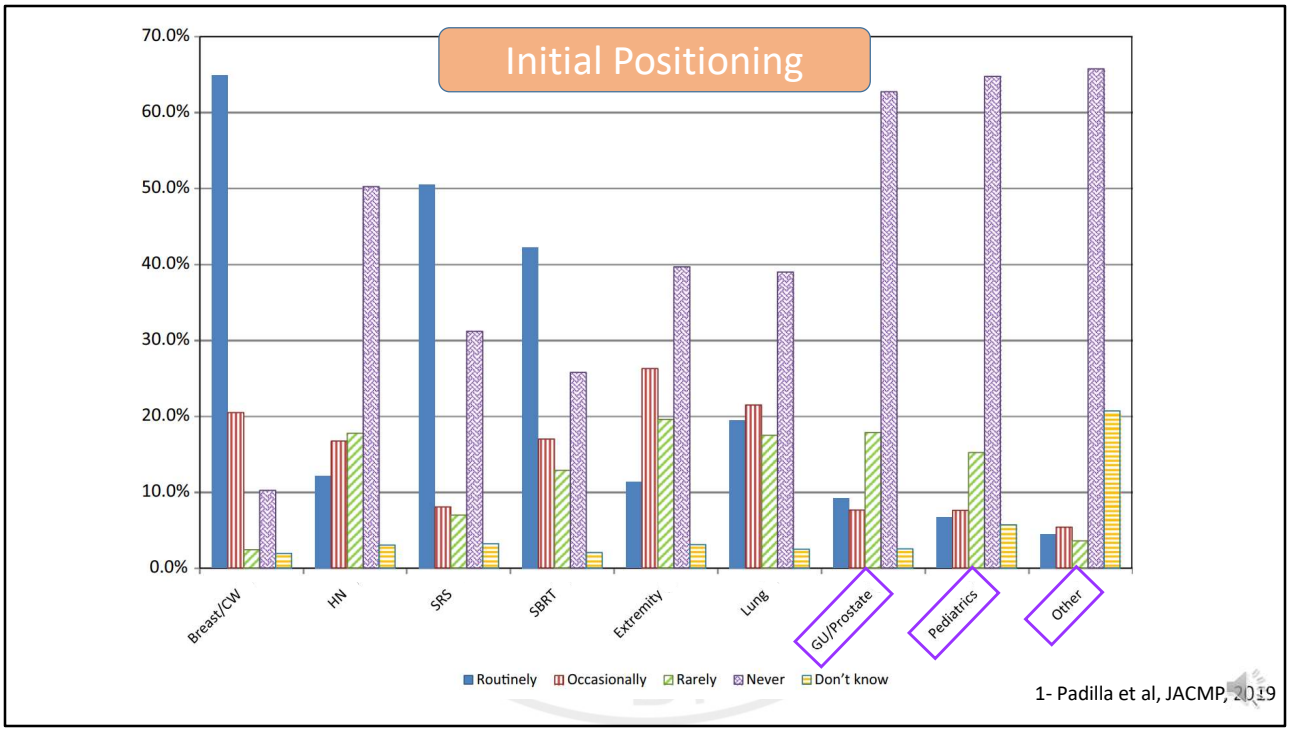
Initial positioning: we asked respondents what types of treatments/sites they use SGRT for and what type of reference surface they use when setting up patients. Majority (63%) use only a DICOM reference for initial positioning at every fraction, while 20% indicated that the type of reference surface they used was dependent on the patient/treatment site.



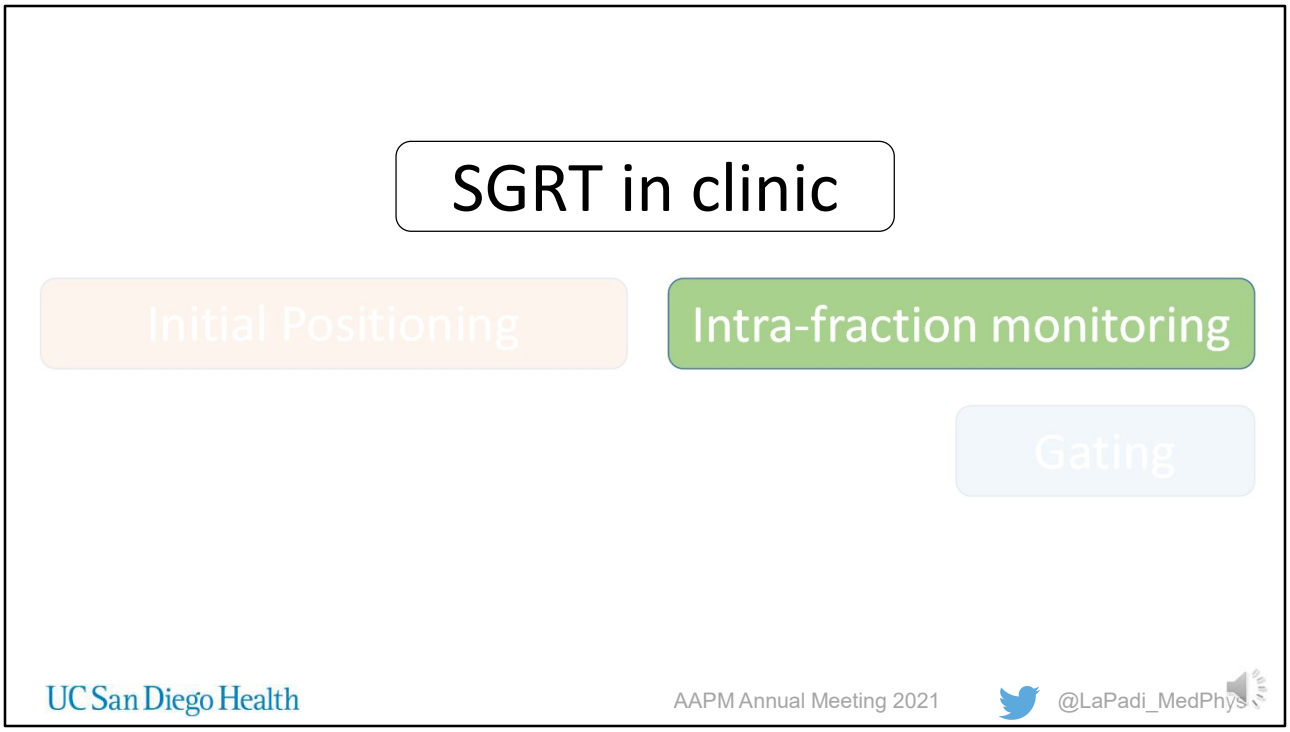
This graph summarizes the results of SGRT use for initial positioning. Solid blue = routinely, Patterned purple = never.



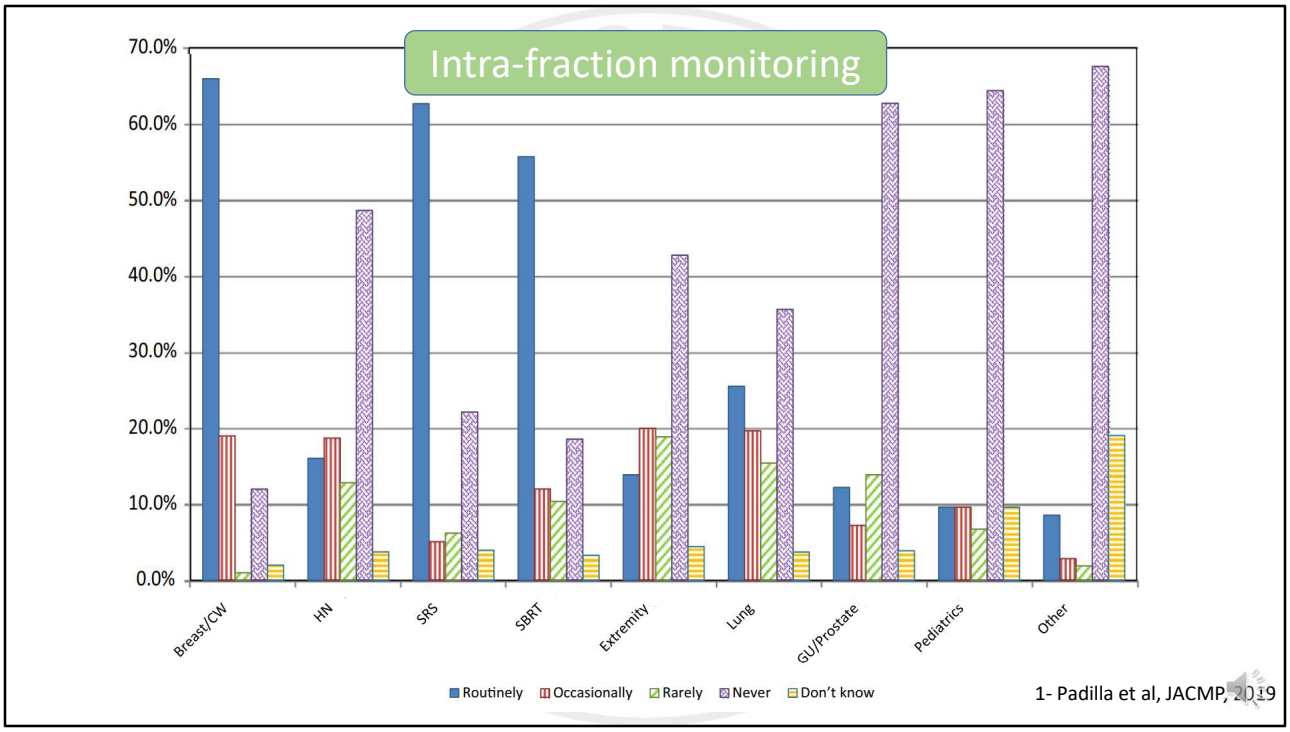
Our survey indicated that SGRT is most often used to set up breast and CW, SRS and SBRT patients. When used for breast, 49% of respondents reported verifying the position with internal imaging daily, and 46% weekly. For SRS and SBRT daily position verification was much higher at 93% and 92%, respectively.



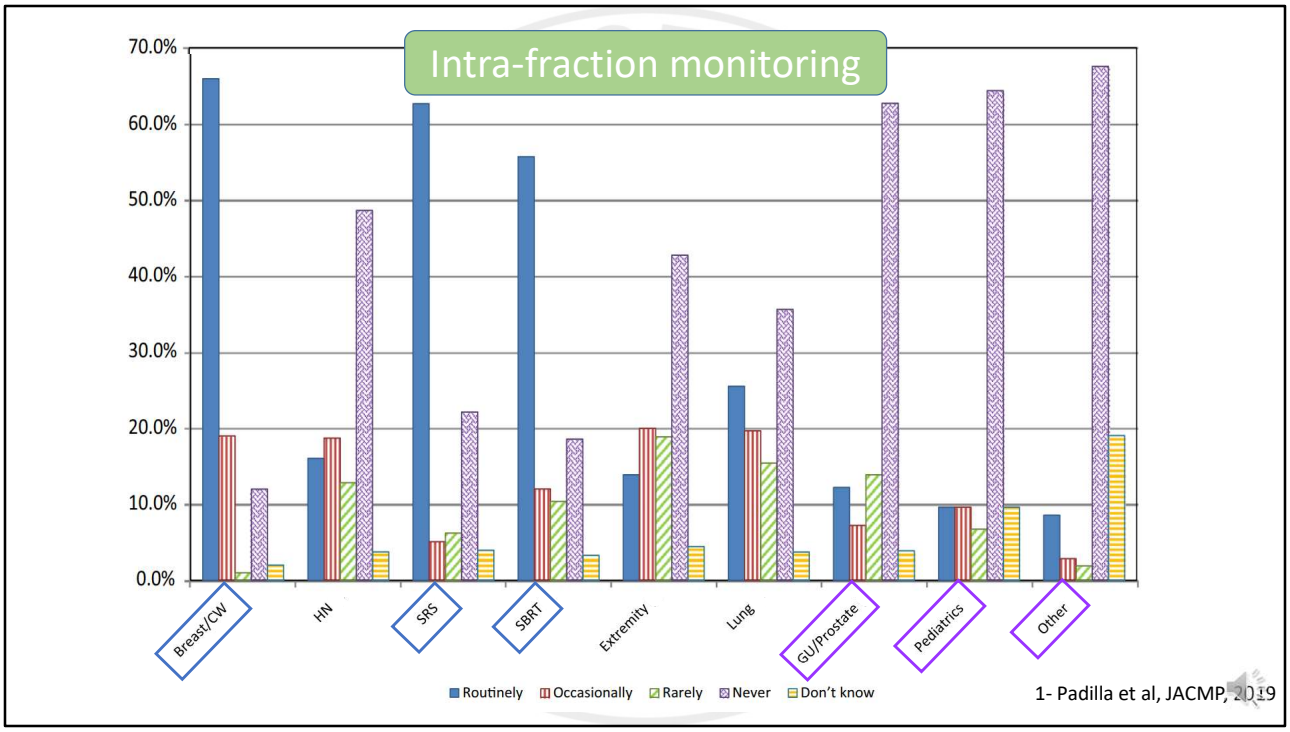
Survey respondents indicated that surface imaging is used much less for GU/prostate, pediatrics, and other treatments.. "Other" includes abdominal treatments (liver, pancreas, etc.), non-GU/prostate pelvis treatments, primary brain, and electron treatments.



For intra-fraction motion, we also asked what types of treatments/sites they use SGRT for and what type of reference surface they used to monitor the patient. 41% use only a camera-acquired reference in the treatment room for intra-fraction monitoring, while 22% used DICOM surface. 30% indicated they select the type of surface depending on the patient/treatment site/type.



This graph summarizes the results of SGRT use for intra-fraction monitoring. Solid blue = routinely, Patterned purple = never.



SI used for intra-fraction monitoring most often for the same sites as initial positioning. Least used sites for intra-fraction monitoring also match with initial positioning results.

SGRT in clinic

Initial Positioning

Intra-fraction monitoring

Gating

Survey results – gating

- 35% use surface imaging at sim for RMM*
- Of all clinical users,
  - 66% use SGRT for gating Breast/CW
  - 33% for SBRT
  - 27% for non-SBRT lung
  - 20% for non-SBRT abdomen

**Out of 34% of respondents with SI at sim*

1- Padilla et al, JACMP, 2019

SGRT for SBRT

SBRT – Initial positioning

SBRT – Initial positioning

- For RT, **SGRT** better or equivalent to skin marks and lasers [2, 3, 4]
- For SBRT, **SGRT prior to CBCT** seems better or equivalent than kV prior to CBCT [5, 6]

SBRT – Intra-fraction monitoring

- Threshold = 2mm
- SGRT and CBCT shifts comparable

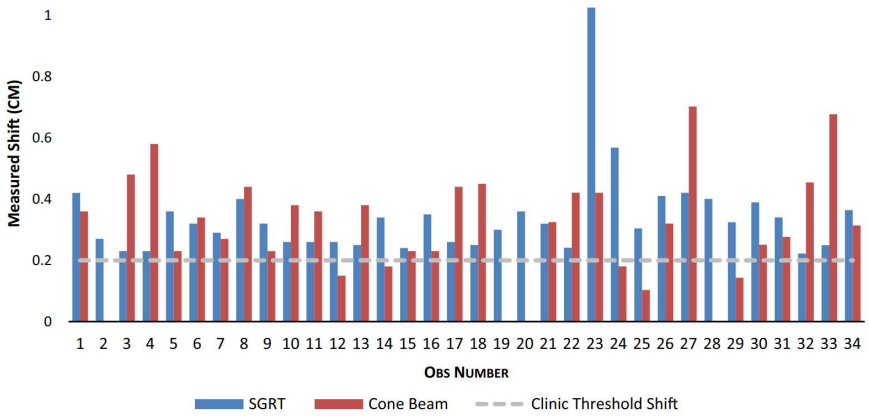


FIG. 1. Vector intrafraction motion detected by SGRT (blue columns) and resulting CBCT shifts (red columns). CBCT, cone beam computed tomography; SGRT, Surface-guided radiation therapy.

6 - Heinzerling et al, JACMP 2020

SBRT – DIBH

Proof of concept: 3 lung and 7 liver patients (41 fxs)

- Inter-fraction: Larger initial CBCT shifts for liver over lung (statistically significant)
- Intra-fraction: Larger DIBH variability for liver over lung (but not statistically significant)

7 - Naumann et al, Frontiers in Onc 2020

Patients set up to SGRT in the room, CBCT acquired under DIBH and shifts applied based on internal anatomy alignment. New reference captured acquired and CBCT repeated for verification.

Higher CBCT shifts recorded in initial CBCT for liver patients (SS). Finding larger shifts on liver is not surprising since surface is often a better surrogate for lung tumors than for liver tumors.

When checking the stability of position intra-fraction, they found that 11% of lung fractions, 21% of liver fractions needed shifts after 2nd CBCT, although this was not statistically significant.

Authors concluded the approach is feasible, but robust workflow incorporating internal imaging is necessary.

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Thank you for your attention!