FROM SRS/SRT TO WIDER CLINICAL APPLICATIONS : EXPANDING UTILIZATION WITH SGRT

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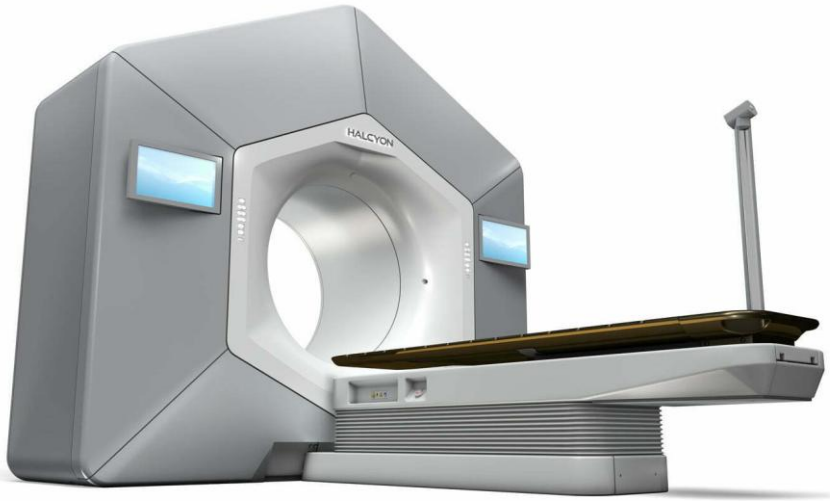

Halcyon 4.0

Truebeam 4.1 with AlignRT 6.3

EXPERIENCE WITH SGRT

Truebeam Installation

Mid 2019

Oct 2019

Truebeam started patient treatment

1st Hyperarc patient treated with OSMS as passive monitoring

Nov 2019

End 2024 until early 2025

Beacon SGRT Project

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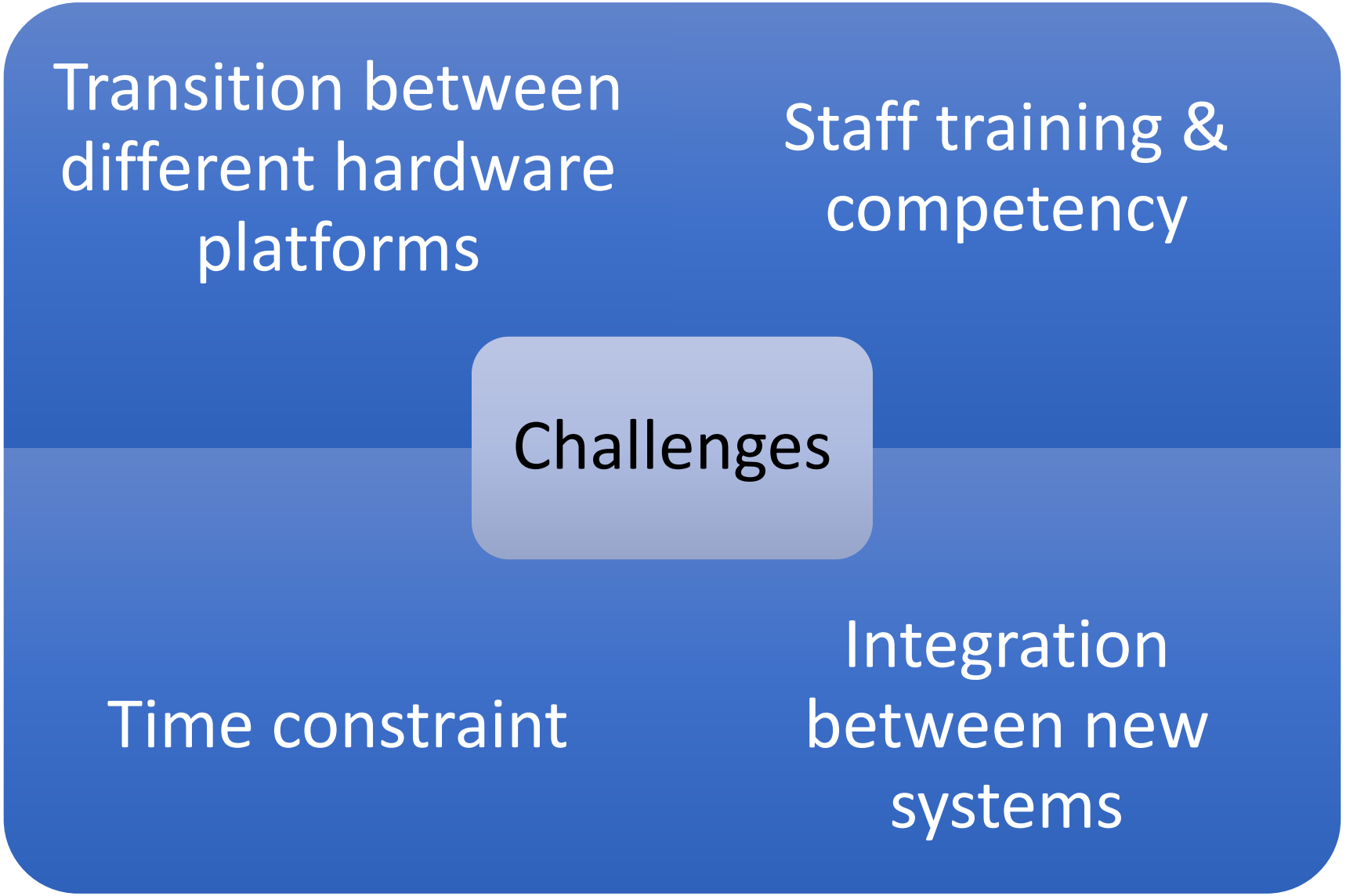
What happened between 2019-2024?


Transition between different hardware platforms
Staff training & competency
Challenges
Time constraint
Integration between new systems

Beacon SGRT Project

Project Initiation

- Discussions began in mid 2024 to optimize & maximize AlignRT utilization

Workflow Development

- Established 3 distinct clinical workflows using retrospective patient data, in close collaboration with clinical application specialist

Target Sites

- Implemented protocols for Thorax & Abdomen, DIBH Breast & Conventional Breast workflows

FLOW SETUP - ALIGNRT

step-by-step flow of how AlignRT works in Surface Guided Radiation Therapy (SGRT)

Select Patient 1

- Identify patient
- Load Treatment Plan
- select CT SIM BODY (1st day tx) at AlignRT
- Select SGRT BODY (for subsequent day)

Patient Positioning 2

- Set Up Patient - refer landmark (move long only)
- Press " Go to Position"
- Move table for translation movement (bring table near the isocentre <1)
- Manually adjust patient (yaw, roll, pitch > 1.5)

Send To Couch 3

- Add imaging at CBCT field and press prepare
- Use AlignRT and press Send To Couch
- Select 6D
- Shift the couch

Perform CBCT 4

- Perform and verify the CBCT
- Press apply

Treatment Delivery 5

- Shift couch to the correct position
- Ensure gantry & OBI is not blocking infrared camera
- Capture for this and future session - AlignRT

FLOW SETUP - ALIGNRT- DIBH

step-by-step flow of how AlignRT works in Surface Guided Radiation Therapy (SGRT)

Select Patient 1

- Identify patient
- Load treatment plan
- Ensure the treatment plan is correctly loaded (CT Sim body Free Breathing & CT Sim Body DIBH in one plan.

Patient Positioning 2

- Select CT Sim Body Free Breathing
- Set Up Patient - refer landmark (move long only)
- Press " Go to Position"
- Move table for translation movement (bring table near the isocentre <1)
- Manually adjust patient (yaw, roll, pitch > 1.5)

Send To Couch 3

- Add imaging at CBCT field and press prepare.
- Use AlignRT and press Send To Couch
- Move Table

Prepare CBCT 4

- Choose plan CT Sim Body DIBH
- Bring Gantry 230° RT side. LT side 125°
- Ask Patient Take A deep Breath & Hold (Vertical Near 0) - AlignRT
- Send To couch , Shift table & Breath Normal

Perform & Analyze CBCT 5

- Ask patient to repeat deep Breath & Hold - to see the reproducible
- Perform CBCT
- Verify CBCT image

Final Verification 6

- Ensure Gantry & OBI not blocking infrared camera.
- Before apply the shift, ask Patient Take A deep Breath & Hold , Shift couch to the correct position
- Capture for this and future session - AlignRT

Proceed With Treatment 7

- Start the treatment
- Continious Monitoring using AlignRT

FLOW SETUP - ALIGNRT
(BREAST CONVENTIONAL FIRST DAY)

step-by-step flow of how AlignRT works in Surface Guided Radiation Therapy (SGRT)

Select Patient 1

- Identify patient
- Load Treatment Plan
- select CT SIM BODY (1st day tx) at AlignRT

Patient Positioning 2

- Set Up Patient - refer landmark
- move table to isocentre (treatment plan)
- play the AlignRT
- Move table for translation movement (bring table near the isocentre <1)
- Manually adjust patient (yaw, roll, pitch > 1)

Send To Couch 3

- Add imaging at CBCT field and press prepare
- Use AlignRT and press Send To Couch
- Select 3D
- Shift the couch

Perform & Verify CBCT 4

- Perform and verify the CBCT
- Press apply
- Shift the couch to correct position

Treatment Field Marking 5

- turn couch to medial tang field
- Check & draw the treatment border on patient's body

Treatment Delivery 6

- Ensure gantry & OBI is not blocking infrared camera
- Capture for this and future session - AlignRT
- treatment delivery

Beacon SGRT Project

Latest Initiative

- Seamless integration of SGRT workflow for all Truebeam patients

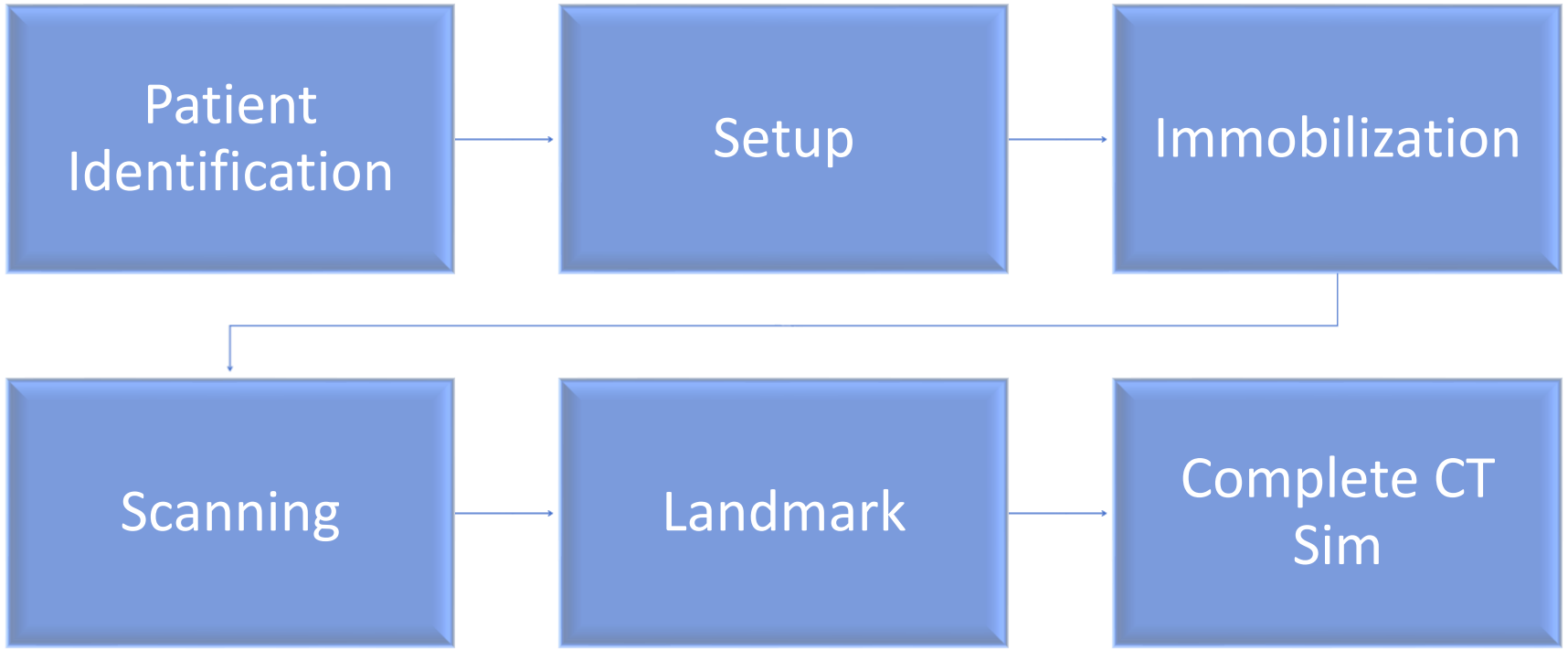
Workflow Development

- Established a standardized dual-level SGRT workflow (CT simulation level & treatment setup level)

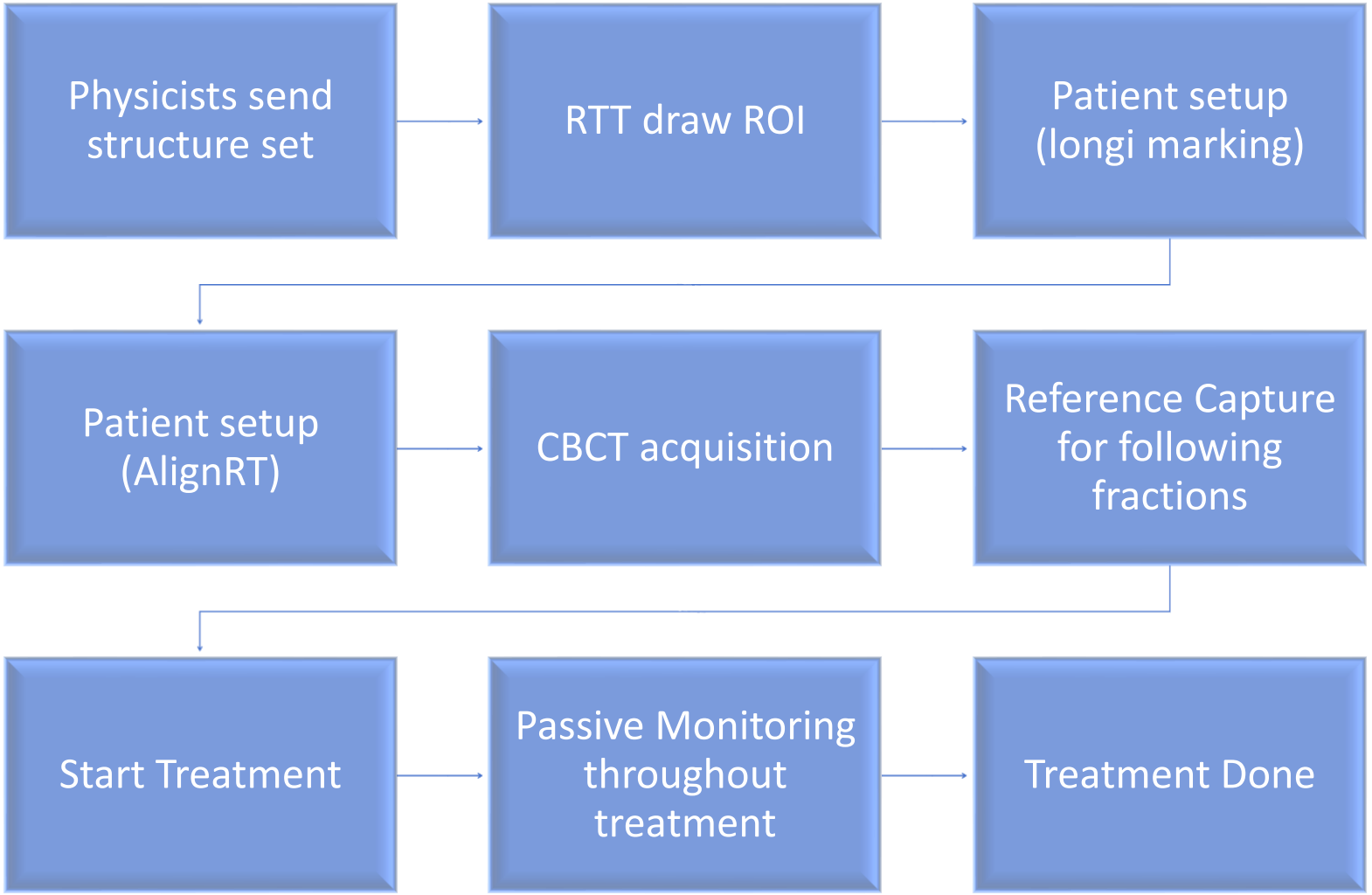
Target Sites

- Head & neck, thorax, abdomen, pelvis & extremities

CT Simulation workflow



Treatment Workflow



Challenges

Patient-specific movement barriers

Expert-guided clinical monitoring

SOP adherence & proficiency

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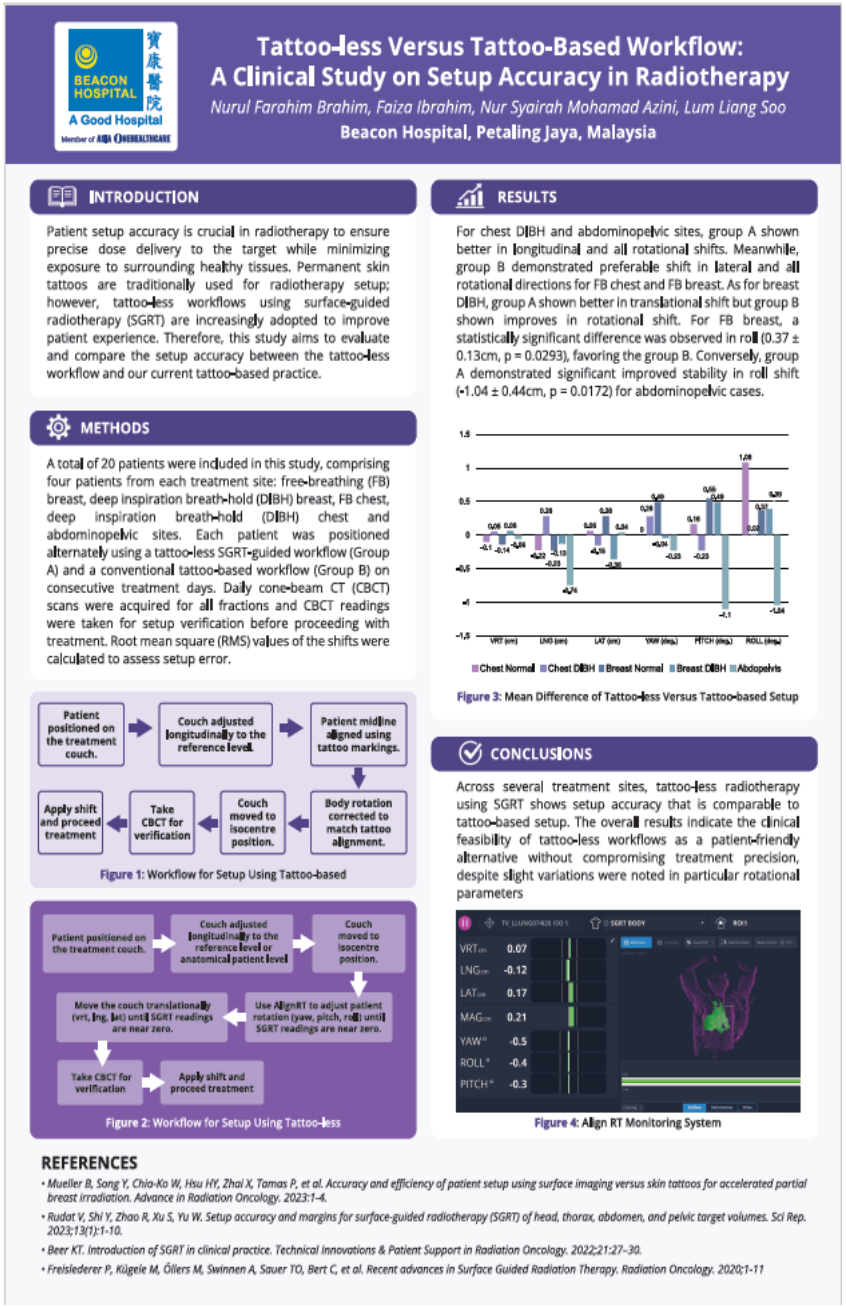
Achievements

October 2025



Tattoo-less Versus Tattoo-Based Workflow: A Clinical Study on Setup Accuracy in Radiotherapy

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INTRODUCTION

Patient setup accuracy is crucial in radiotherapy to ensure precise dose delivery to the target while minimizing exposure to surrounding healthy tissues. Permanent skin tattoos are traditionally used for radiotherapy setup; however, tattoo-less workflows using surface-guided radiotherapy (SGRT) are increasingly adopted to improve patient experience. Therefore, this study aims to evaluate and compare the setup accuracy between the tattoo-less workflow and our current tattoo-based practice.

METHODS

A total of 20 patients were included in this study, comprising four patients from each treatment site: free-breathing (FB) breast, deep inspiration breath-hold (DIBH) breast, FB chest, deep inspiration breath-hold (DIBH) chest and abdominopelvic sites. Each patient was positioned alternately using a tattoo-less SGRT-guided workflow (Group A) and a conventional tattoo-based workflow (Group B) on consecutive treatment days. Daily cone-beam CT (CBCT) scans were acquired for all fractions and CBCT readings were taken for setup verification before proceeding with treatment. Root mean square (RMS) values of the shifts were calculated to assess setup error.

Figure 1: Workflow for Setup Using Tattoo-based

Figure 2: Workflow for Setup Using Tattoo-less

RESULTS

For chest DIBH and abdominopelvic sites, group A shown better in longitudinal and all rotational shifts. Meanwhile, group B demonstrated preferable shift in lateral and all rotational directions for FB chest and FB breast. As for breast DIBH, group A shown better in translational shift but group B shown improves in rotational shift. For FB breast, a statistically significant difference was observed in roll (0.37 ± 0.13cm, p = 0.0293), favoring the group B. Conversely, group A demonstrated significant improved stability in roll shift (-1.04 ± 0.44cm, p = 0.0172) for abdominopelvic cases.

Figure 3: Mean Difference of Tattoo-less Versus Tattoo-based Setup

CONCLUSIONS

Across several treatment sites, tattoo-less radiotherapy using SGRT shows setup accuracy that is comparable to tattoo-based setup. The overall results indicate the clinical feasibility of tattoo-less workflows as a patient-friendly alternative without compromising treatment precision, despite slight variations were noted in particular rotational parameters

Figure 4: Align RT Monitoring System

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- Tattoo-less vs Tattoo-Based Workflow : A Clinical Study on Setup Accuracy in Radiotherapy
- To evaluate & compare the setup accuracy between tattooless & current tattoo-based practice in DIBH & abdominopelvic patients
- Tattooless workflow using SGRT shows setup accuracy is comparable to tattoo-based workflow

- A Comparison on Effectiveness & Accuracy of Breast Radiotherapy Patient Setup Using SGRT & Tattoo
- To evaluate & compare the setup accuracy & effectiveness between the tattoo-less workflow & current tattoo-based practice in Breast Conventional patients
- SGRT workflow provides comparable setup accuracy to conventional tattoo-based setup for Breast Conventional despite slightly longer setup time

A COMPARISON ON EFFECTIVENESS AND ACCURACY OF BREAST RADIOTHERAPY PATIENT SETUP USING SGRT AND TATTOO

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INTRODUCTION

Surface Guided Radiation Therapy (SGRT) has been widely used to improve patient setup accuracy and treatment efficiency in modern radiotherapy. With the growing interest in improving patient comfort and simplifying the workflow, there is a need to evaluate the feasibility of SGRT for a tattoo-less setup approach. Therefore, this study aims to evaluate and compare the setup accuracy and effectiveness between the tattoo-less workflow and our current tattoo-based practice.

METHODS

15 breast cancer patients who underwent breast radiotherapy

Align the patients using AlignRT (SGRT) alternating daily with using tattoos

Daily CBCT acquired for image verification

Setup time & table shifts recorded

RESULTS

SGRT setup demonstrated slightly smaller in translational RMS shifts (vertical 0.24 cm, longitudinal 0.30 cm, lateral 0.46 cm) compared with tattoo-based setup (0.30 cm, 0.55 cm, 0.54 cm). Meanwhile, rotational errors were a bit higher with SGRT setup showing RMS values of 1.02°, 0.85°, and 0.85° for yaw, pitch, and roll respectively, versus 0.93°, 0.74°, and 0.81° for tattoo-based setup. Significant differences between the two workflows were observed in vertical ($p = 0.0034$), longitudinal ($p = 0.0004$), and pitch ($p = 0.0001$). As for the setup efficiency, the SGRT workflow required slightly longer setup time (mean difference 1.07 ± 1.28 minutes, $p = 0.0061$), with median in-room times of 6.0 minutes for both workflows.

Figure 2: RMS of Setup Error for SGRT Versus Tattoo-based

Figure 1: Patient Count for Setup Time (SGRT Versus Tattoo-based)

Figure 4: SGRT setup Using AlignRT v6.3

CONCLUSION

SGRT workflow provides comparable setup accuracy to conventional tattoo-based setups for breast radiotherapy, with minor differences in translational and rotational directions. Despite slightly longer setup times, the SGRT workflow remains efficient and may enhance patient experience by eliminating skin tattoos while maintaining precise treatment delivery.

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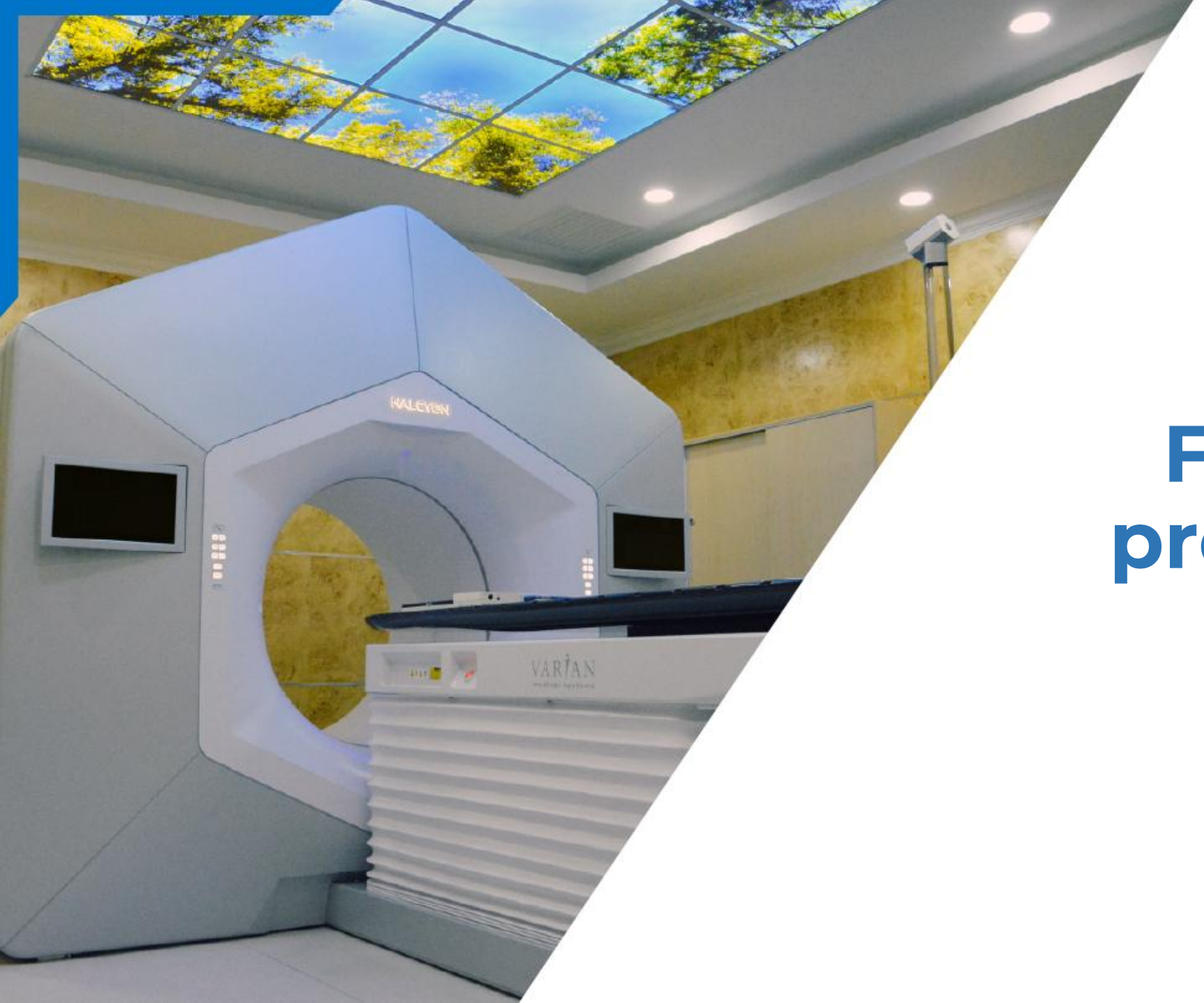

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Future projects?

THANK YOU

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