Brachytherapy at Karolinska University Hospital

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Region Stockholm

Agenda

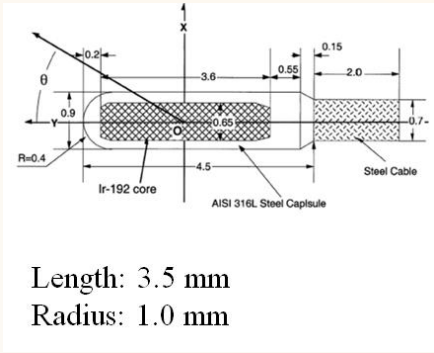
- Intro to Brachytherapy
- Brachytherapy organization and equipment
- Brachytherapy treatments
- 3Dprinted applicators; developement, MDR and clinical start



Intro Brachytherapy

The word "brachytherapy" comes from the Greek word βραχύς, brachys, meaning "short-distance" or "short"

- Brachytherapy – Radiation therapy with active sealed sources that are placed close to or inside the region to be treated by the use of applicators
- Main isotop used is ^{192}Ir in modern brachytherapy
- Used in the form of a wire with the source at the tip
- An afterloader is used to steer the source within the applicatorn



Schematic ^{192}Ir source



Source wire



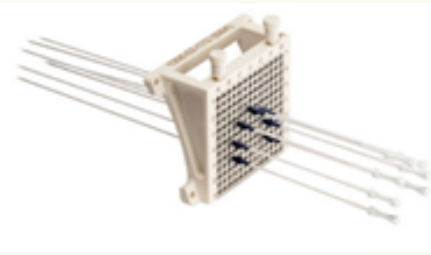
Basal cell carcinoma of the face, St Petersburg 1903



Afterloader



Cervix applicator



Prostate applicators

Radiotherapy organisation at Karolinska University Hospital

Department of Brachytherapy

- Separate unit, incoporated under Radiation Therapy department
  - 9 oncology nurses
  - Oncologists with brachy competence: 11 (working partially in brachy)
  - 9 medical physicists of them in brachy (6 FTE)
  - 1 professor in brachy medical physics

Brachytherapy Equipment at Karolinska University Hospital

Hardware

TREATMENT DELIVERY UNITS:

3 **Brachy HDR afterloaders**
1 Varian Bravos
2 Elekta Flexitron

1 P+ Ariane
(50 Kv contact Xray)

Plaques for ocular treatments

IMAGING MODALITIES

2 Ultrasounds BK3000
1 Ultrasound Toshiba Apilo
3 C-arms Ziehm RFD 3D

1,5 MR (1.5 T and 3 T) – Philips

1,5 CT – Siemens

Software

TREATMENT PLANNING SYSTEMS:

Oncentra Brachy (TPS)
Vitesse (TPS)
Brachytherapy planning (TPS)
ARIA as Oncology Information System (OIS)

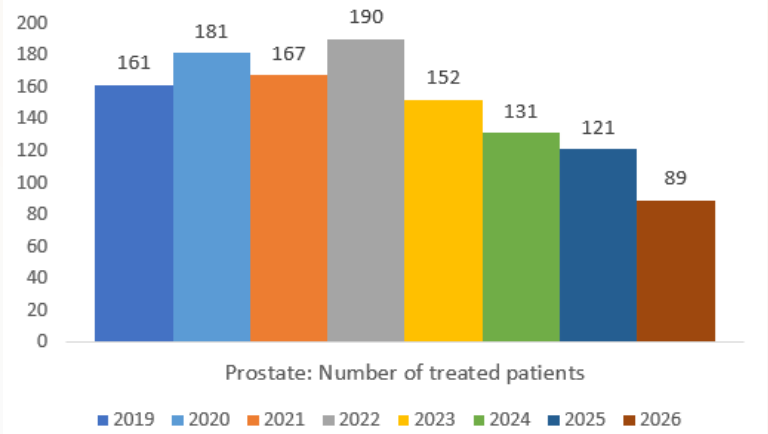
Supporting software

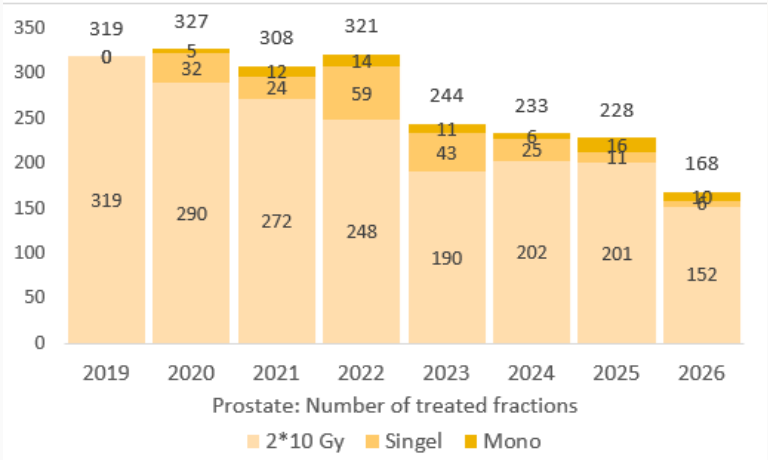
E-doc
Citrix

Mobius
Sun Nuclear Dose Check (under installation)

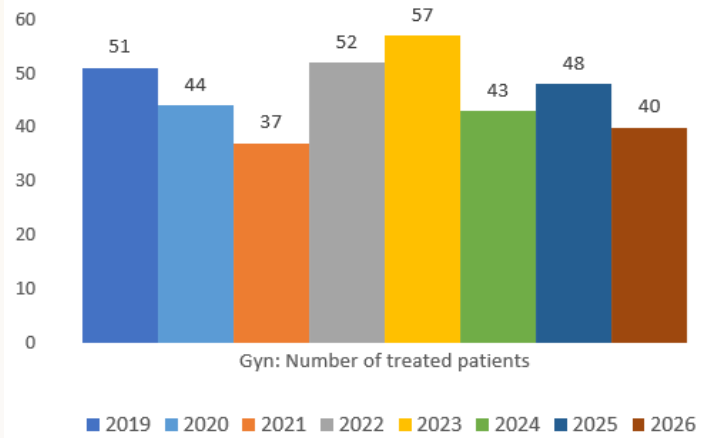
Brachytherapy Treatments at Karolinska University Hospital (until sep-26)

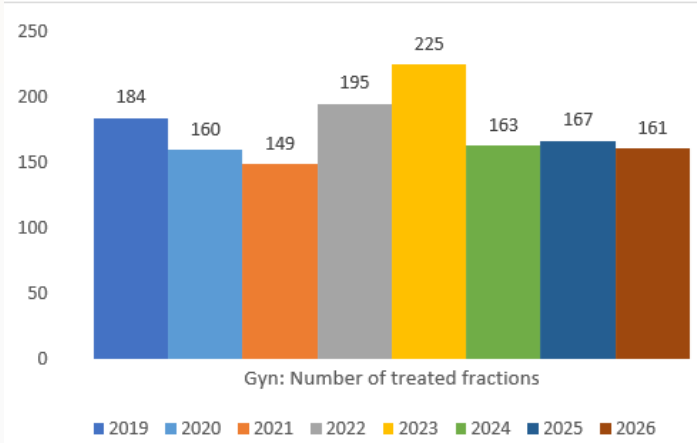
Prostate



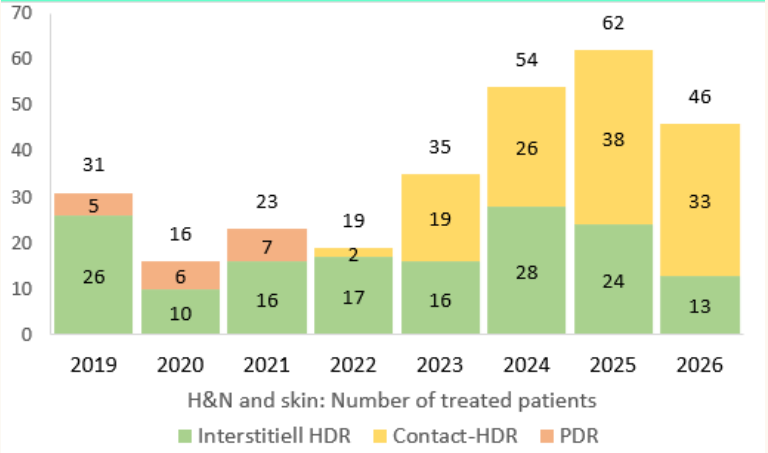


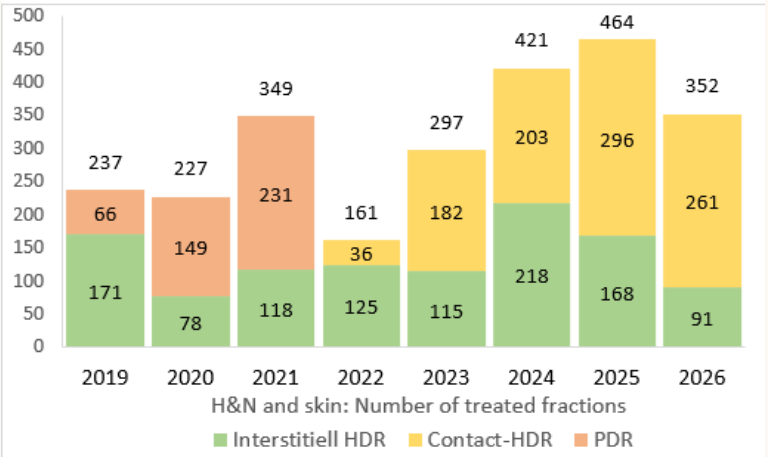
Gyn





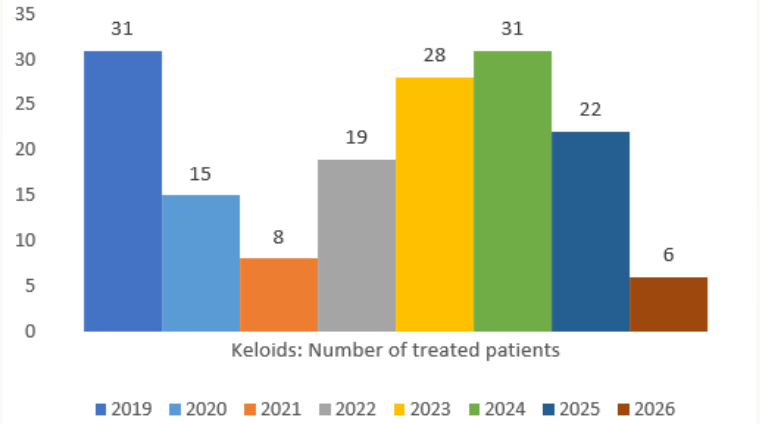
H&N and Skin

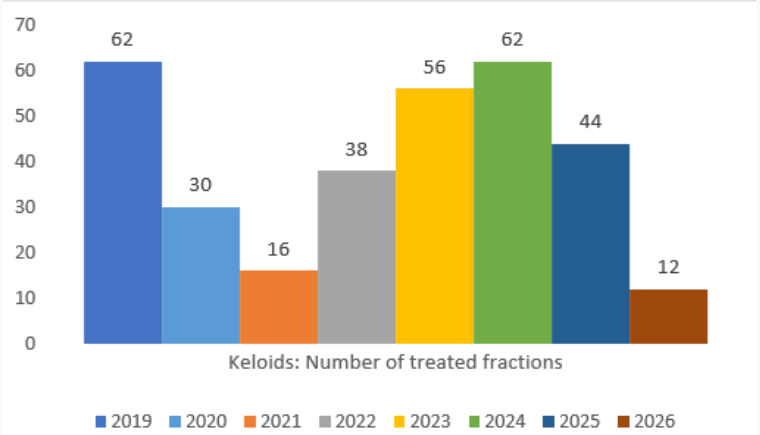




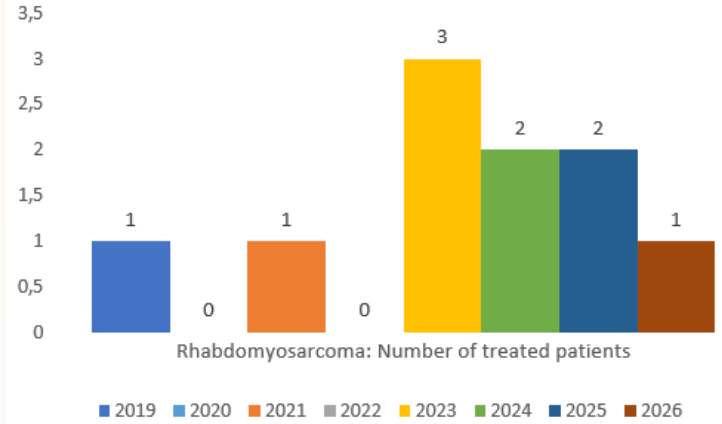
Brachytherapy Treatments at Karolinska University Hospital (until sep-26)

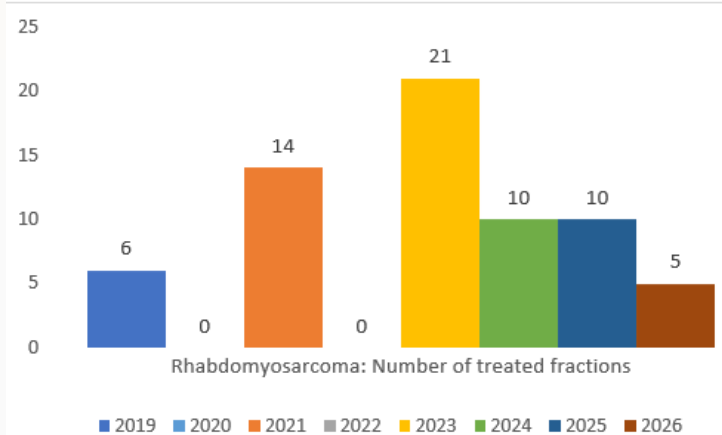
Keloids



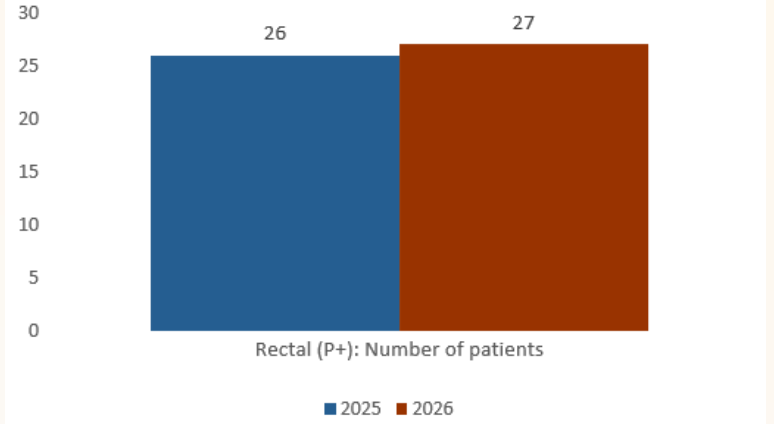


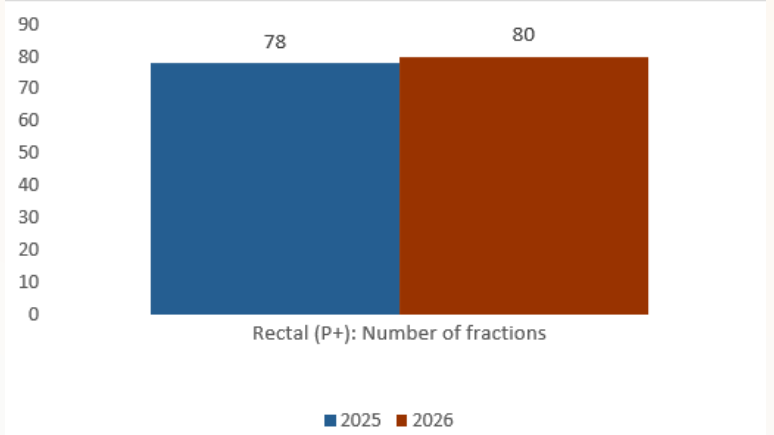
Rhabdomyosarcoma



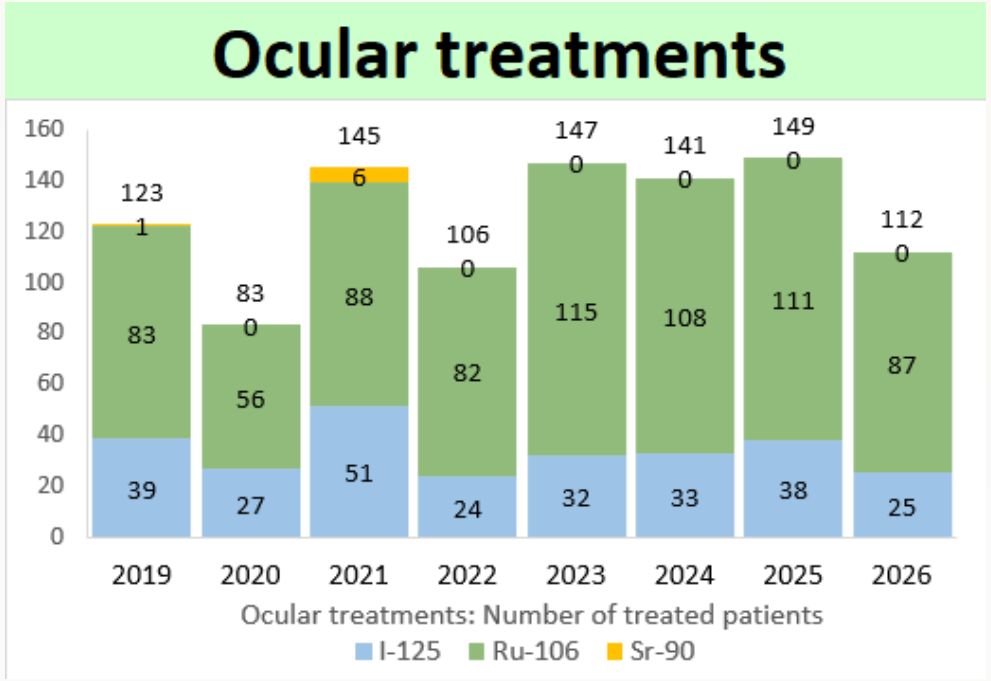


Rectal (P+)





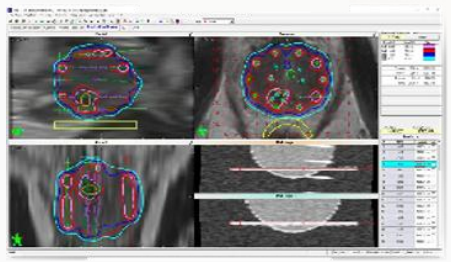
Brachytherapy Treatments at Karolinska University Hospital (until sep-26)





Brachytherapy Treatments - Prostate

Image acquisition → Treatment planning → Treatment verification → Final treatment planning → Treatment delivery → Treatment documentation





VITESSE, BK 3000



ZIEHM RFD 3D



BRACHYTHERAPY PLANNING



BRAVOS HDR



ARIA OIS

Brachytherapy Treatments – GYN, H&N etc.

SCRIPT

eDOC

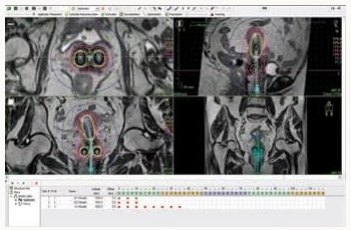
Applicator placement → Image acquisition → Treatment planning → Treatment documentation → Treatment verification → Treatment delivery → Treatment documentation



Applicator, Elekta



CT/MR



ONCENTRA BRACHY



BRACHYTHERAPY PLANNING







FLEXITON HDR



ARIA OIS

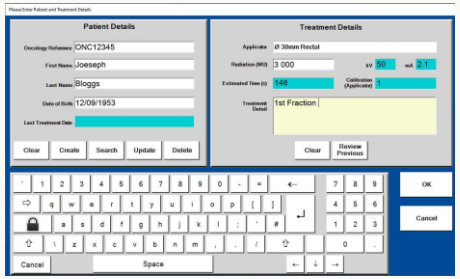
Brachytherapy Treatments – RECTI (CONTACT X-RAY P+)

Applicator placement



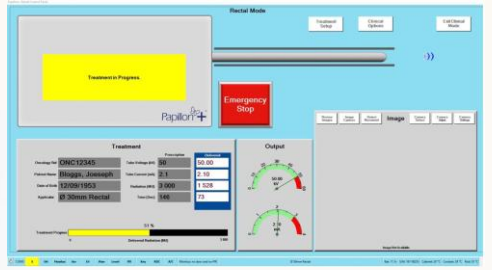
Rectal applicators

”Treatment planning”



P+ Control Software

Treatment delivery



P+ Control Software



P+

Treatment documentation



ARIA OIS

3Dprinted applicators, developement, MDR and clinical start

Development Timeline – Skin Brachytherapy at Karolinska

Early 2022
Project start: Skin treatments using commercially available applicators

September 2022
First skin treatment using brachytherapy

October 2023
Project start: Development of a fixation solution to enable treatment of larger regions using the Freiburg Flap

Early 2024
First treatments using the Freiburg Flap

Mid-2024
Project start: 3D-printed applicator development

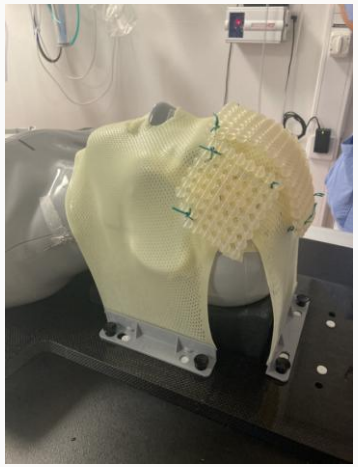
March 2025
MDR process started

March 2026
First treatment using a 3D-printed applicator for the nose

October 2026
MDR scope extended to enable treatment of the skin as an organ, rather than being limited to the nose region.

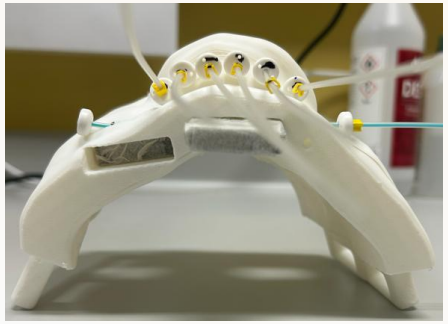


Valencia applicators, Elekta



Treatment setup using Freiburg Flab, Elekta





3D-printed applicators, often used in combinations with lead shields.

3Dprinted applicators, developement, MDR and clinical start

MDR-process

- Qualification of medical device acording to (Eu) 2017/745 (MDR)
  - An accessory to a medical device
  - Custom-made device

- General safety and performance requirement (Annex 1)
  - Results in applicable requirements => requirement specification

- Risk analysis
  - Identify risks, link risk to risk contols, identify new requirements

- Verification and validation report

- Change Control Procedure/plan

- Post-Market Clinical Follow-up plan
- Etc.

Total time to approve the 3D printed applicator according to MDR: 10 month
Support from internal specialists at stab technologi at Karolinska

Thank you for the attention!

Questions?