

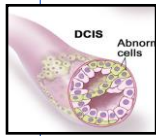
Intraoperative Radiation Therapy for Early Stage Breast Cancer



Adhisabandh Chulakadabba, MD; FRCS(Eng.); FRCS(Ed.)

Tanawat Tawonwong, Ph.D.

Early Stage Breast Cancer



Early Stage

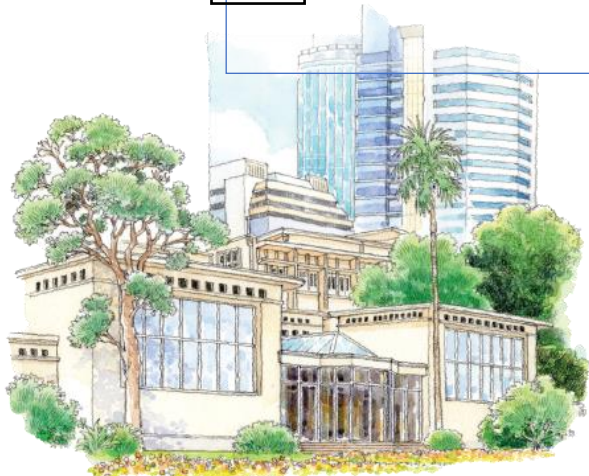
2B &
3A-C

Locally advanced

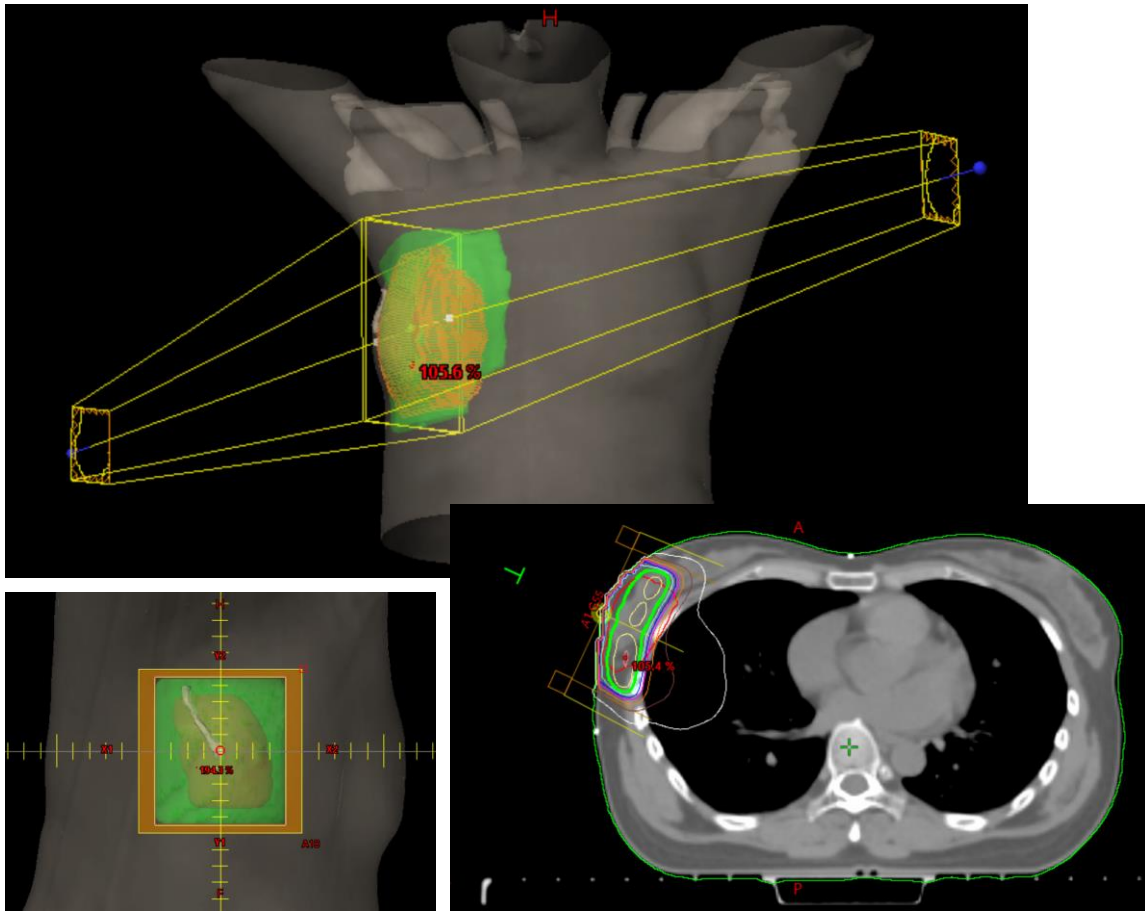
4

Metastatic

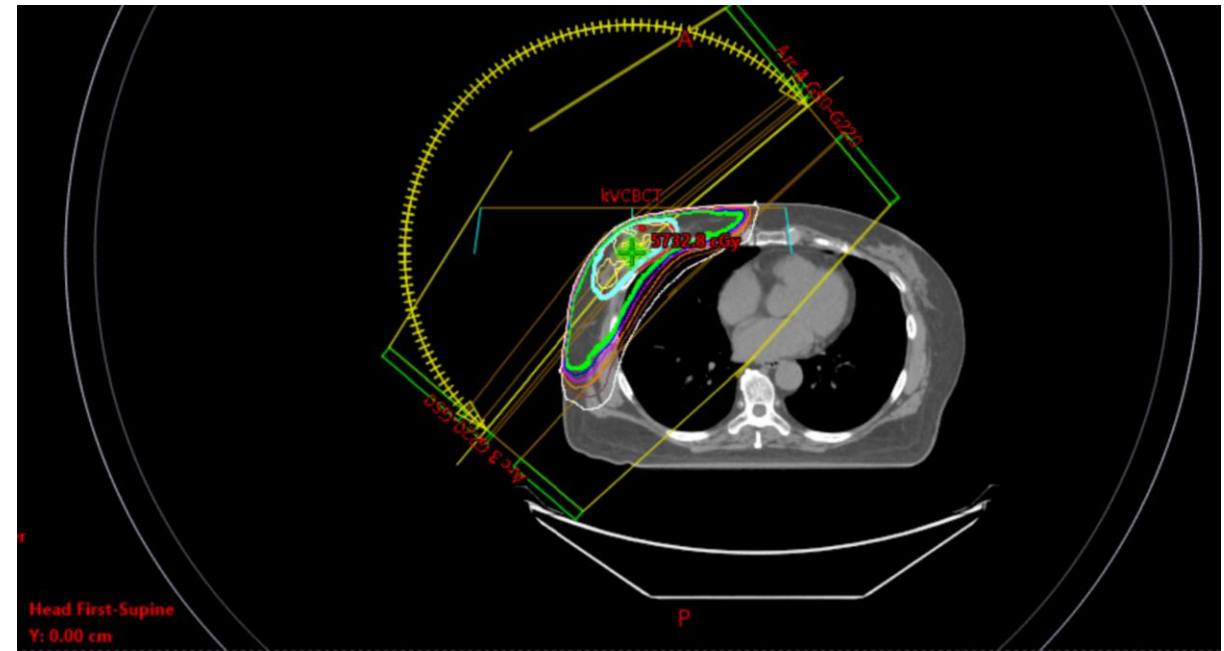
- Stage 0 (In Situ)
 - Tumor < 20 mm and spread to ≤ 3 lymph nodes
 - Or tumor is 20 to 50 mm and no positive lymph nodes
- Stages 1A, 1B and 2A
- Lumpectomy
 - WBRT \pm Boost
 - **Partial breast irradiation (option in some cases)**
 - Only (not for most people)
- Mastectomy



External Beam Radiation Therapy



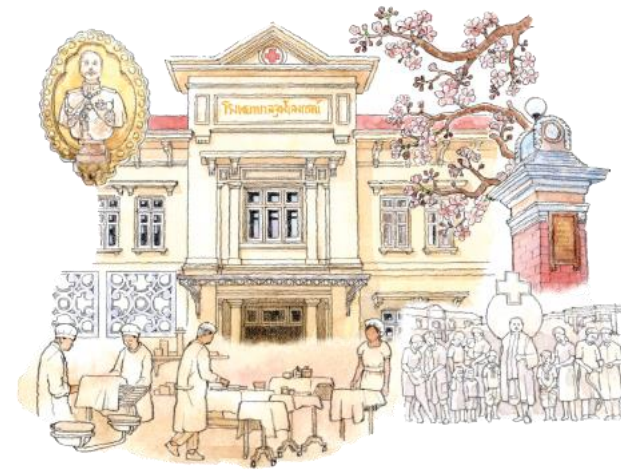
WBRT + e^- Boost



Simultaneous Integrated Boost: SIB

Intraoperative Radiation Therapy: IORT

- Large dose of ionizing radiation to tumor or tumor bed during surgery
- Effect less to surrounding tissue

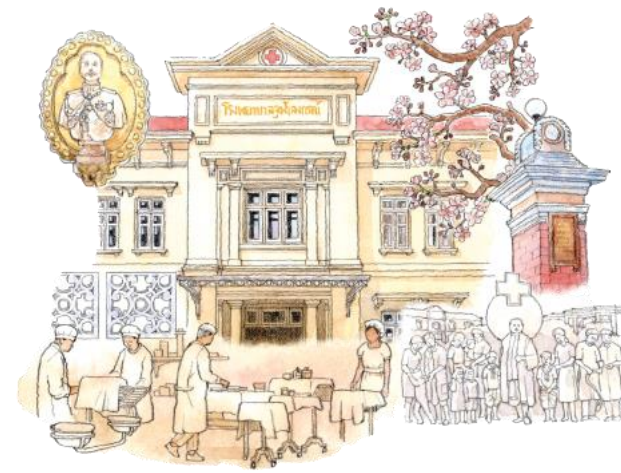


Electron



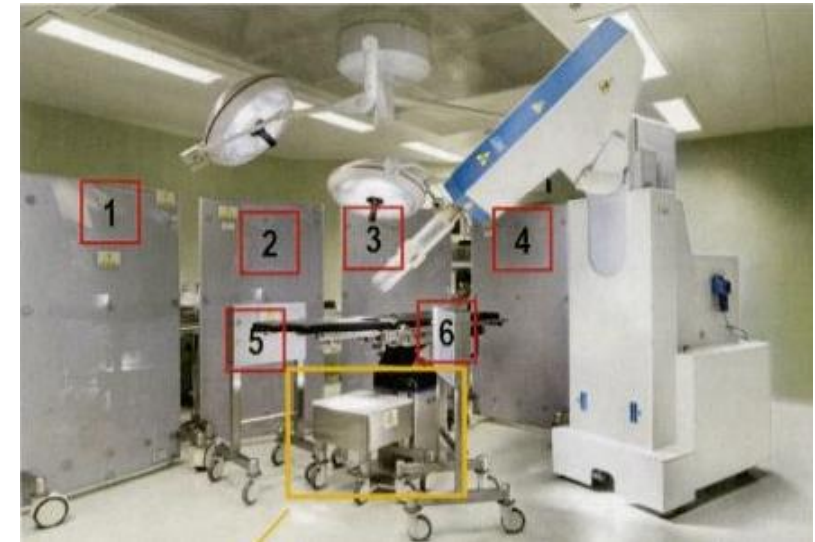
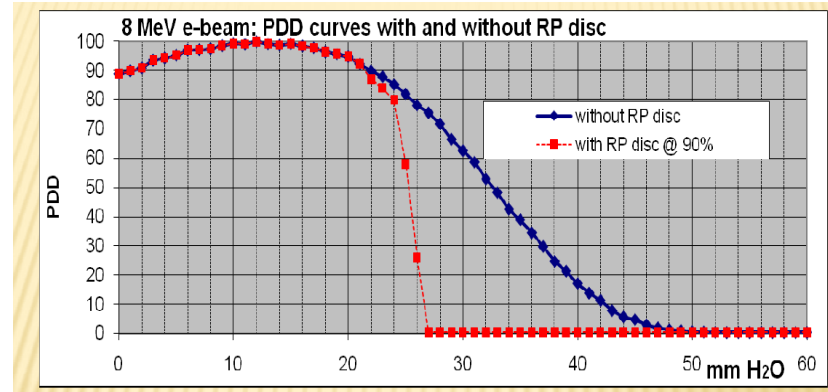
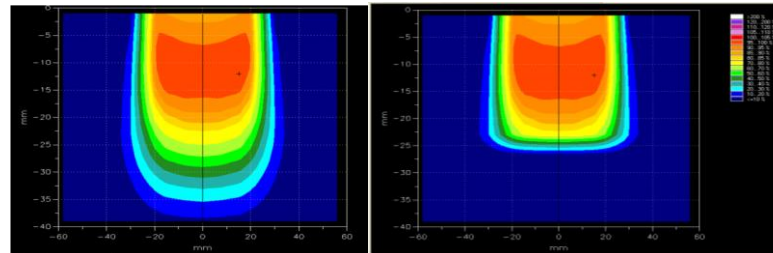
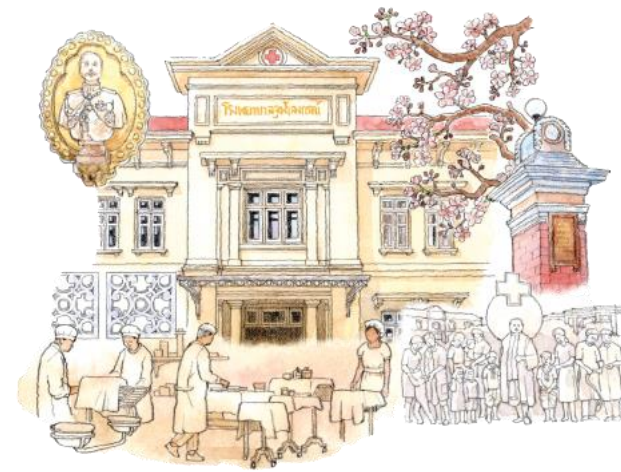
kV X-ray

Requirements for IORT

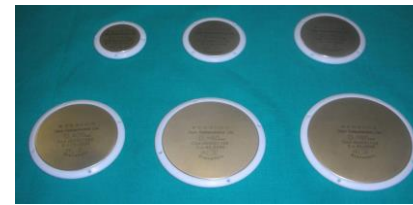
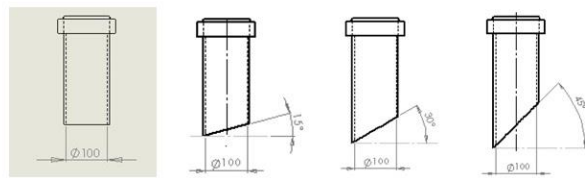


- The IORT procedure requires an **operating room** for the surgical procedure and a **treatment room** for radiation dose delivery.
- Often both the operating room and the radiation treatment room are **merged**, resulting in a **specially shielded operating suite**.

Liac IOERT



Dose delivery: 20 – 120 sec
Total time: 10 – 35 minutes



Energy: 4, 6, 8, 10 & 12 MeV
Field \varnothing : 3, 4, 5, 6, 7, 8 & 10 cm

Credit: K.Thida Niyomthai
National Cancer Institute

IntraBEAM (ZEISS): 50 kVp

Probe Adjuster & IC Holder

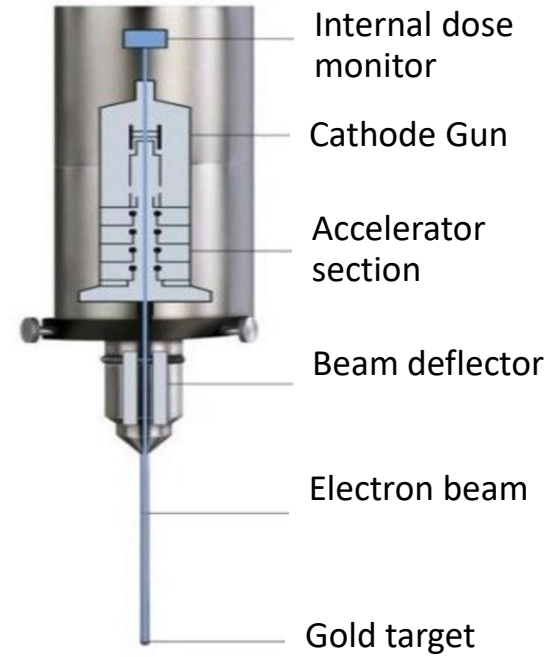


Photo Diode Array

QA Tools

Dose monitoring system

Control unit & Robotic stand



X-ray source



Applicators

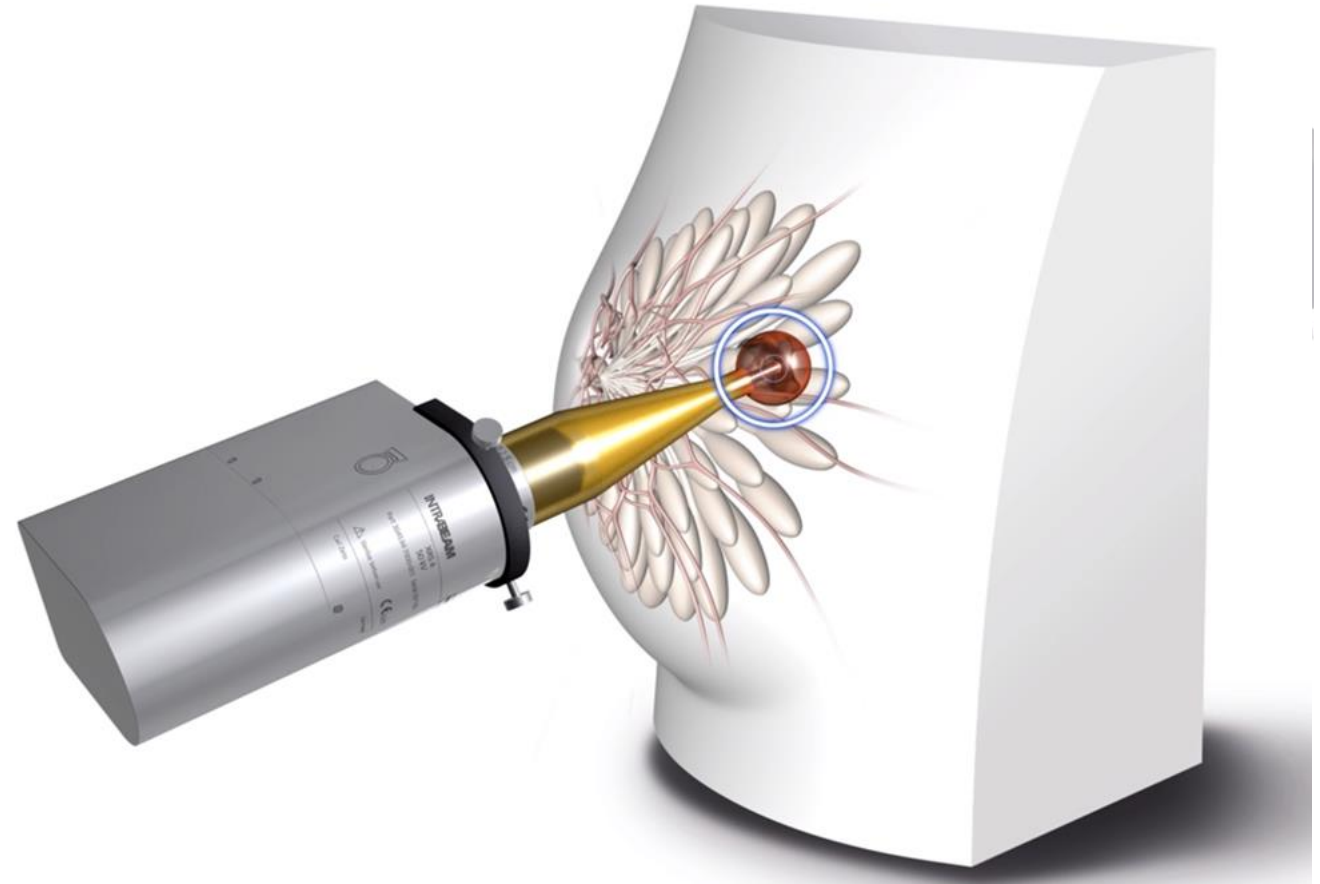
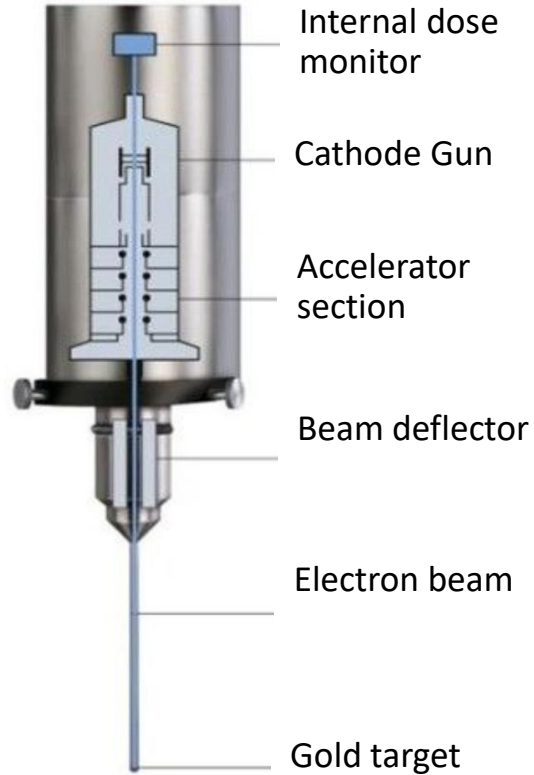
∅: 1.5 – 5 cm

Tx time: 10 – 50 min



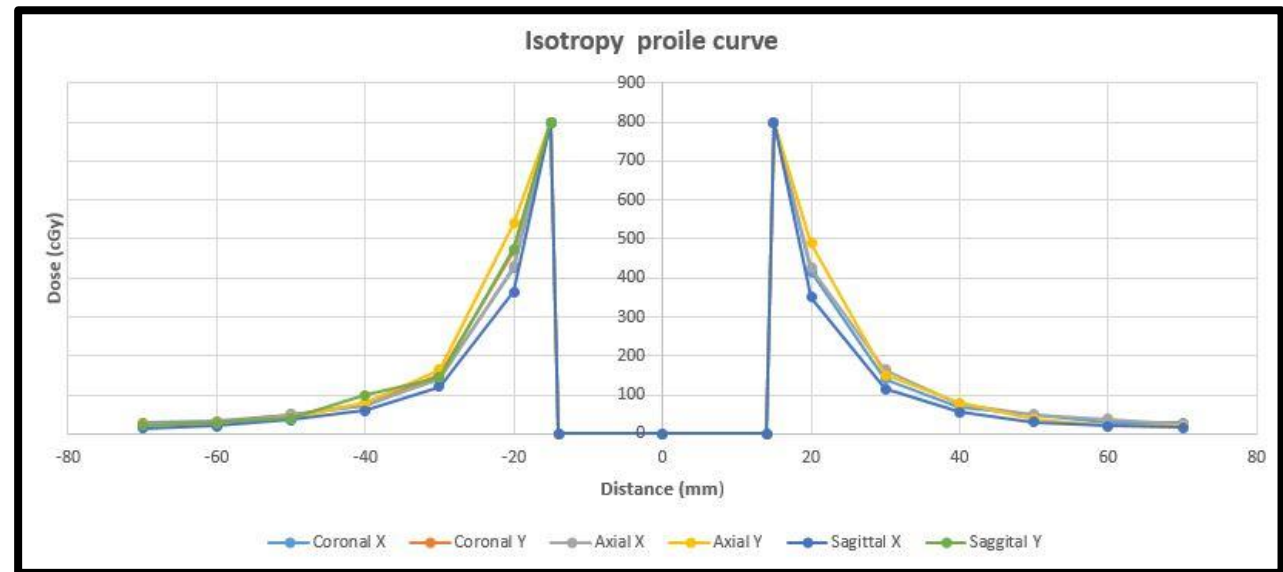
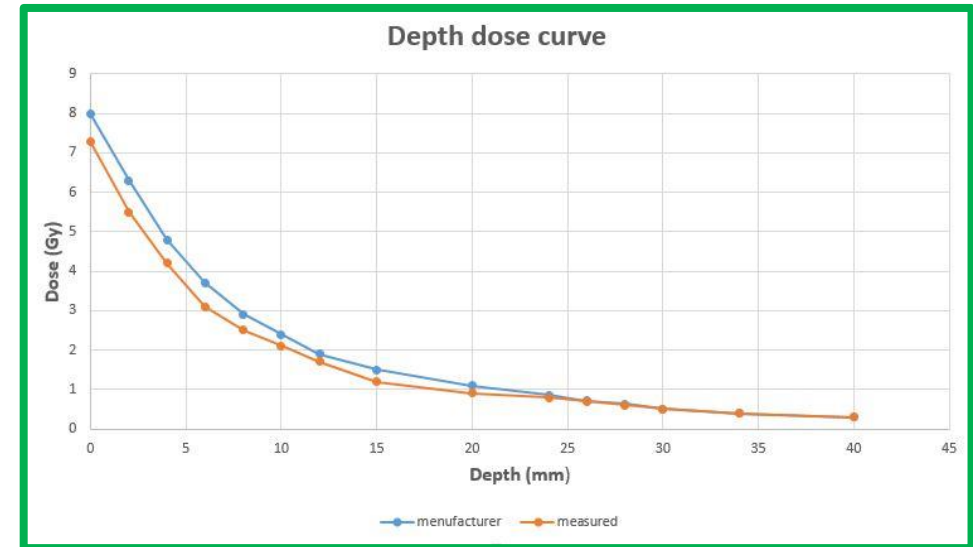
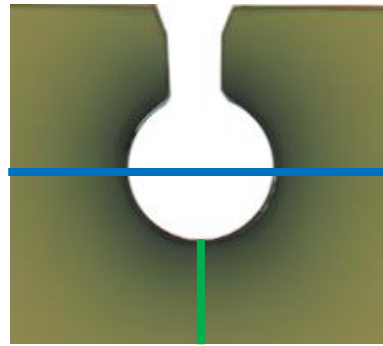
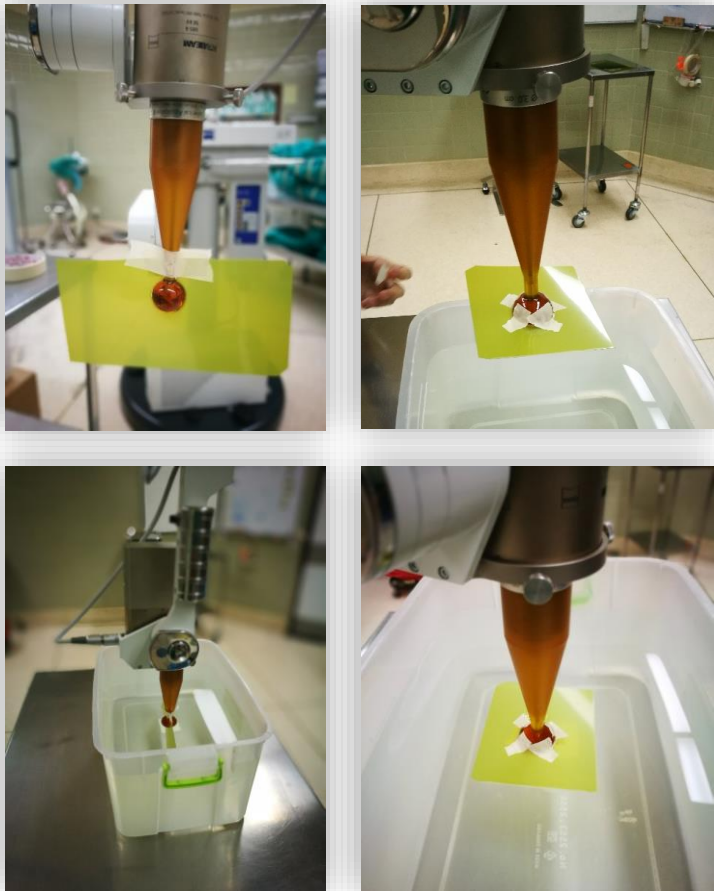
How it's work?

X-ray source



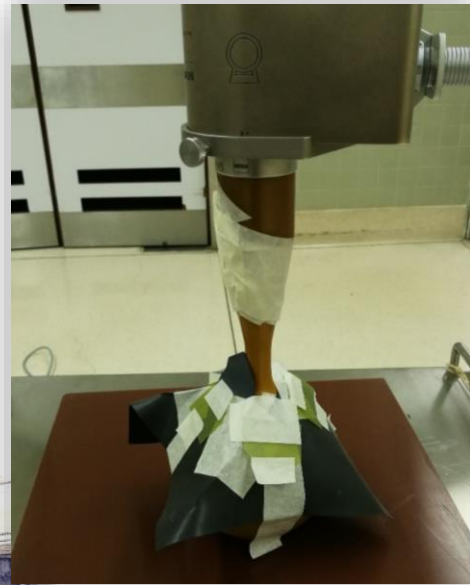
Beam characteristics: Gafchromic EBT 3 film

Depth dose curve and Isotropy



Beam characteristics: Gafchromic EBT 3 film

Shielding effect

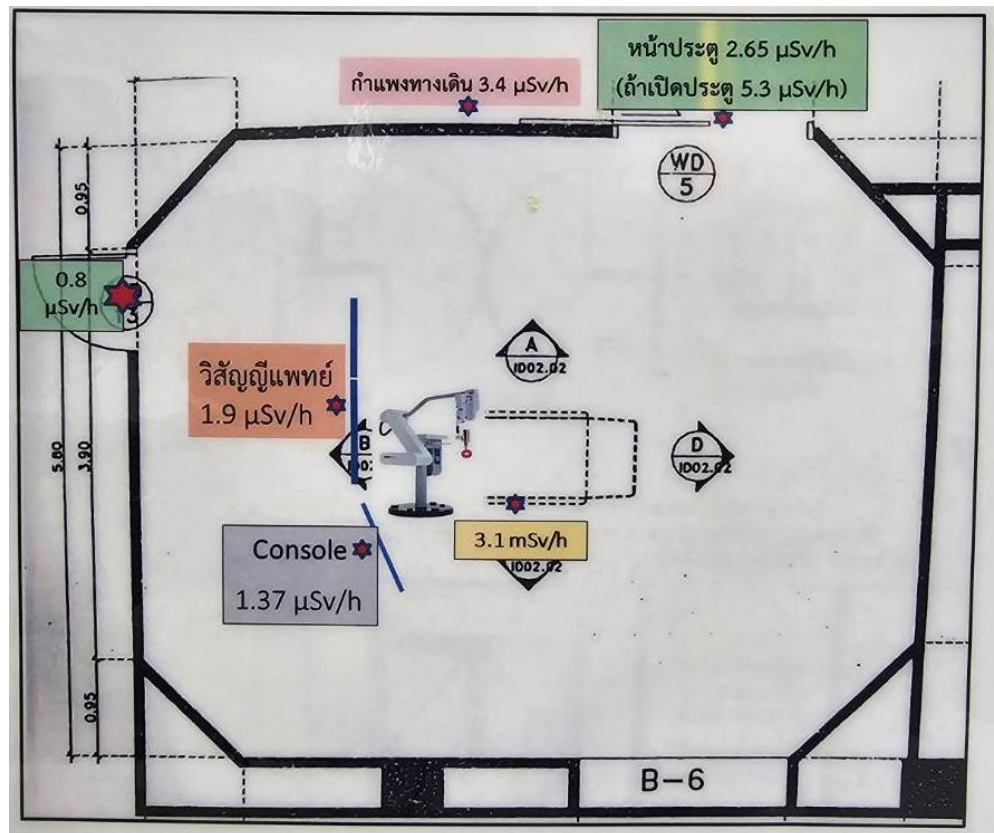


position	Dose (cGy)		% reduction
	W/O shielding	With shielding	
Front	224.33	17.27	92.3
Back	184.3	22.75	87.6
Right	200.48	20.98	89.5
Left	202.15	22.75	88.7

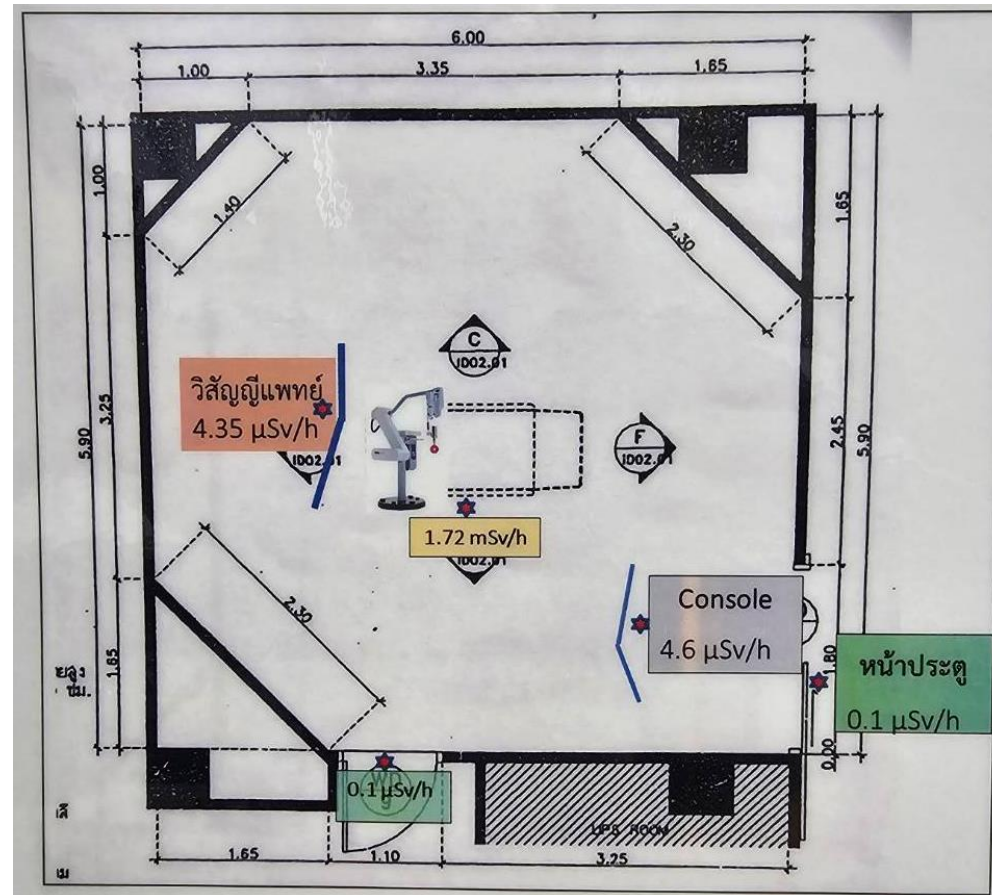


Radiation Safety

Room 1



Room 2



Dose limit: 10 $\mu\text{Sv/hr}$ (20 mSv/y)

Credit: K. Puntiva Oonsiri, KCMH

IntraBEAM



20 Gy @ applicator surface >> 5 Gy @ 1 cm away

Registration for License



- 50 kV 0.04 mA
- Superficial X-ray
- Mobile unit
- Group 2
- Radiation Therapy



Thank you





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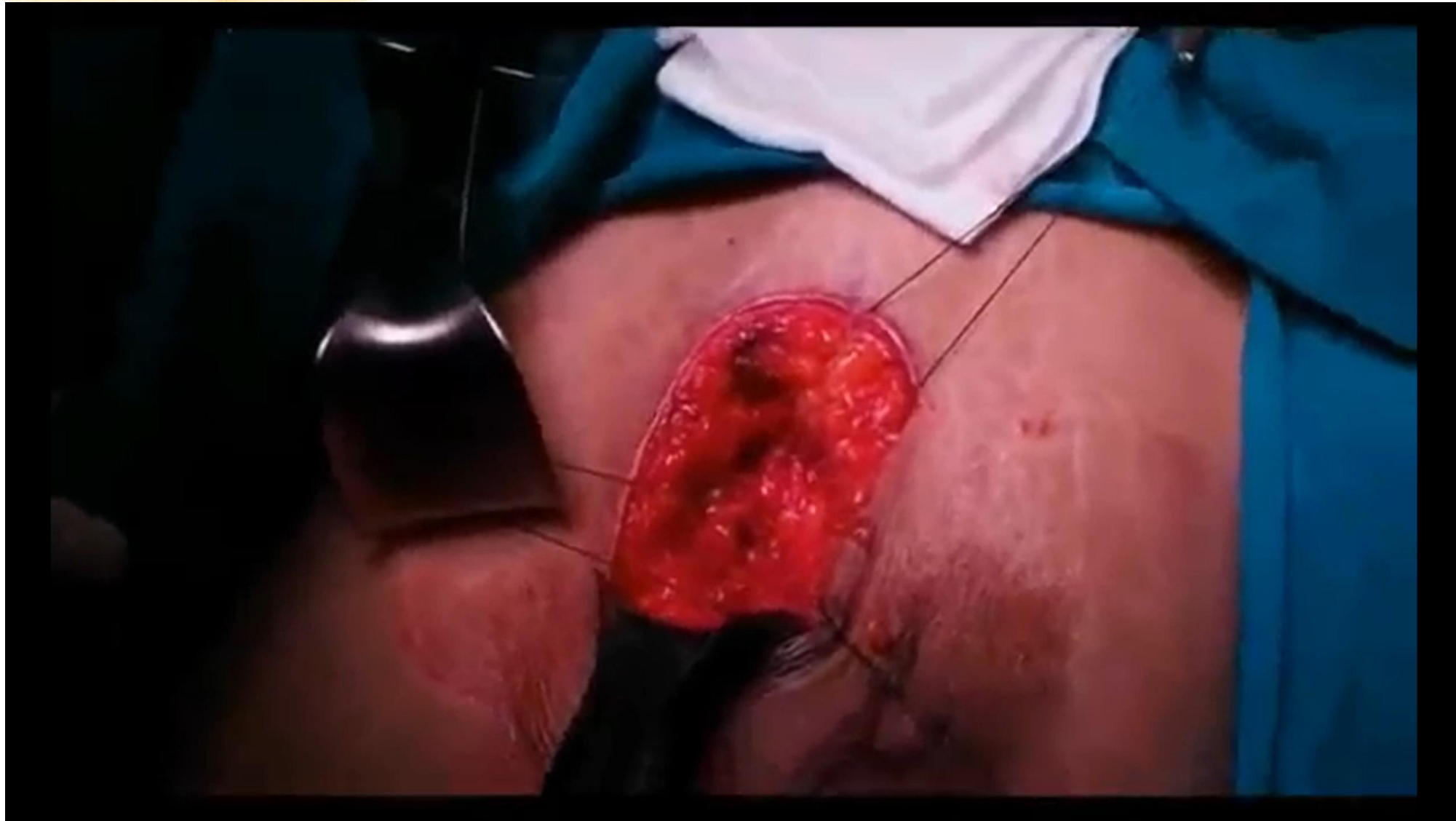
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Operation >> applicator selection >> packing



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Operation >> applicator selection >> packing



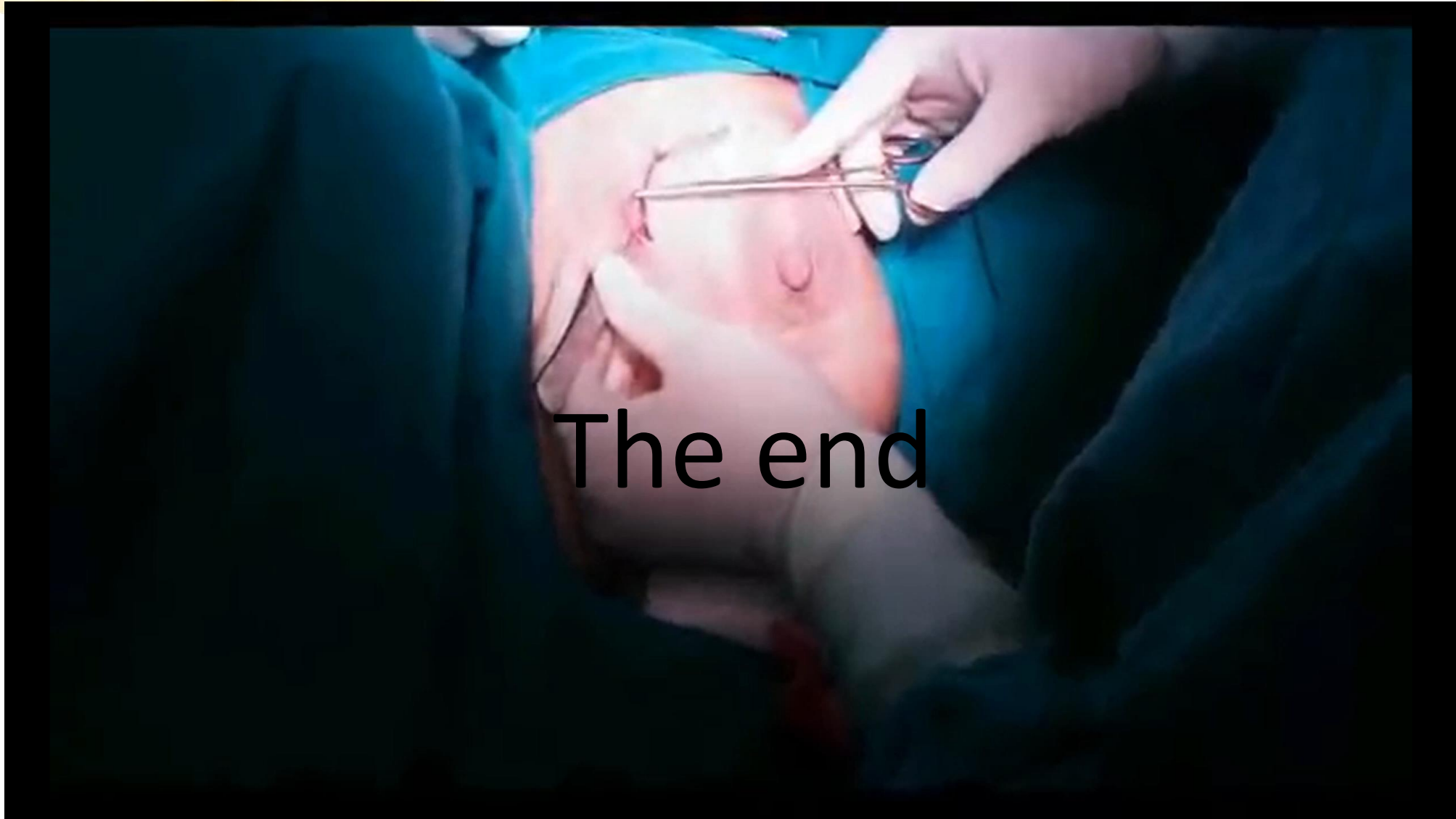
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Applicator removal & suture close