Reflecting on the future – CRPA 2017

Radiation safety following the death of a patient implanted with sealed radioactive sources and the role of the RSO

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OUTLINE

- **Available resources**
- **Brachytherapy**
  - What is brachytherapy
  - What technique we are using
- **Brachytherapy and Radiation Safety**
- **Relevant Regulations and RSO**
- **Deceased patients and Radiation Safety**
  - Funeral Home
  - Morgue

Available Resources

- **NCRP Report No. 37**
  - Precautions in the management of patients who have received therapeutic amounts of radionuclides. Oct, 1970
- **NCRP Report No. 155**
  - Management of Radionuclide Therapy patients, Jan 2006
- **ICRP 98**
  - Radiation Safety of brachytherapy for prostate cancer using permanently implanted seeds, 2005

Available Resources

- **NCRP 37 and NCRP 155**
  - Provided detailed guideline to handle deceased patients (embalming, cremation) who died after receiving radionuclide treatments
  - The reports covered various types of therapeutic procedures
- **ICRP 98**
  - Specifically discussed about the permanent implants of I125 and Pd103 for prostate brachytherapy.

Brachytherpy

- **Brachytherapy is defined as;**
  - **Targeted cancer treatment where a radiation source is placed a short distance from or in the tumor**

Brachytherpy

- **Brachytherapy**

- **LDR – Low dose rate brachytherapy**
- **Manual brachytherapy**
- **HDR – High doserate brachytherapy**
- **PDR – Pulse doserate brachytherapy**

Brachytherpy

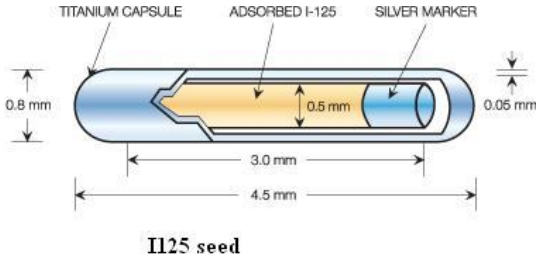
- **Low/intermediate risk patients are chosen as candidate for permanent seed implantation - brachytherapy**
  - Survival rate is high
    - ~100% in 5 years
    - Recurrence rate is ~5% in 5 years
- **It is not anticipated that patient will die from the complications from the treatment**
  - Patient died after brachytherapy
    - Heart attack
    - Car accident
    - Other complication

Brachytherpy – at TBCC

- **Prostate brachytherapy**
  - We treat approximately 94 patients every year
  - Last five years we have treated approximately 470 patients
- **Breast brachytherapy**
  - We started Nov 2013
    - Treated 31 patients until now

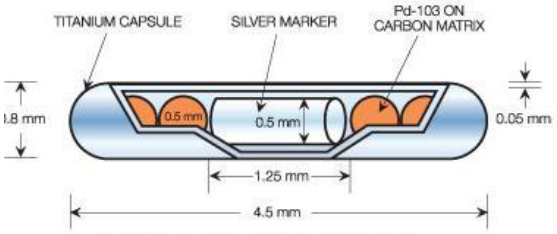
Brachytherpy – at TBCC

Typical dimension and composition of I-125 seed



I125 seed

Typical dimension and composition of Pd-103 seed



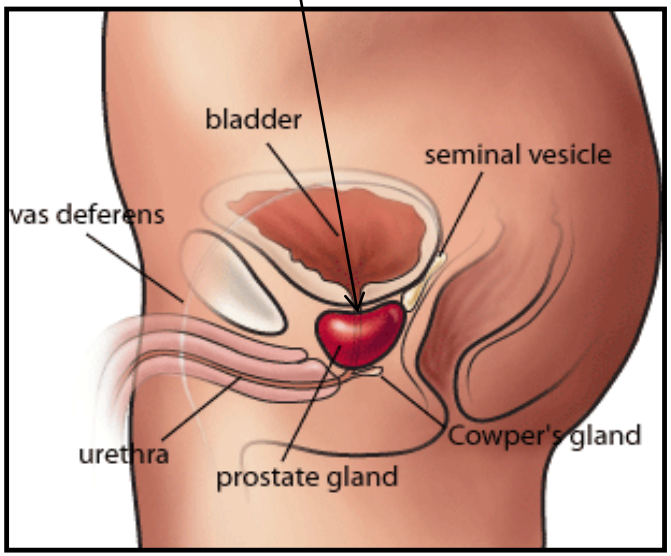
IsoAid Advantage™ (model IAPd - 103A) Pd-103 source

Pd-103 Seeds

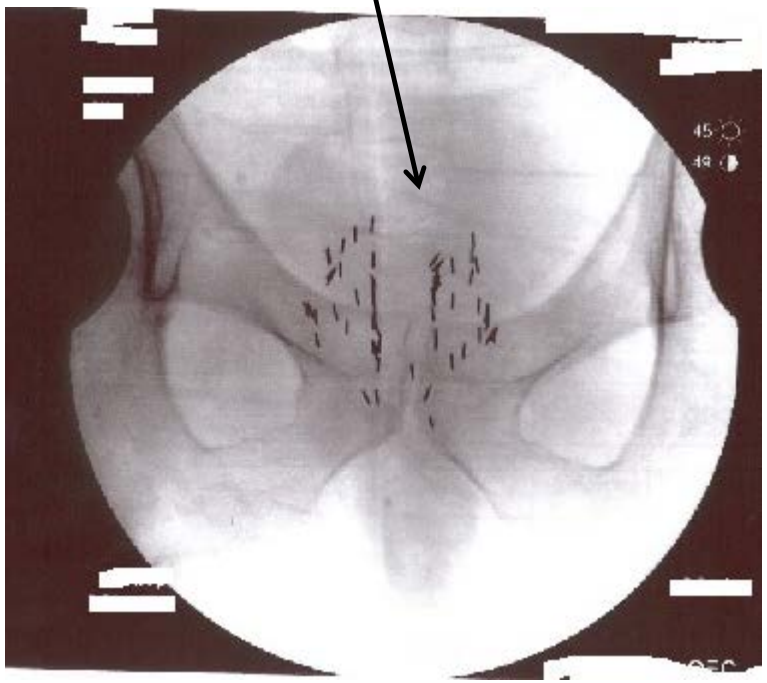
The seeds remain in the patient for the rest of their lives
Titanium is used as it is very bio-compatible

Prostate brachytherapy – at TBCC

Prostate gland

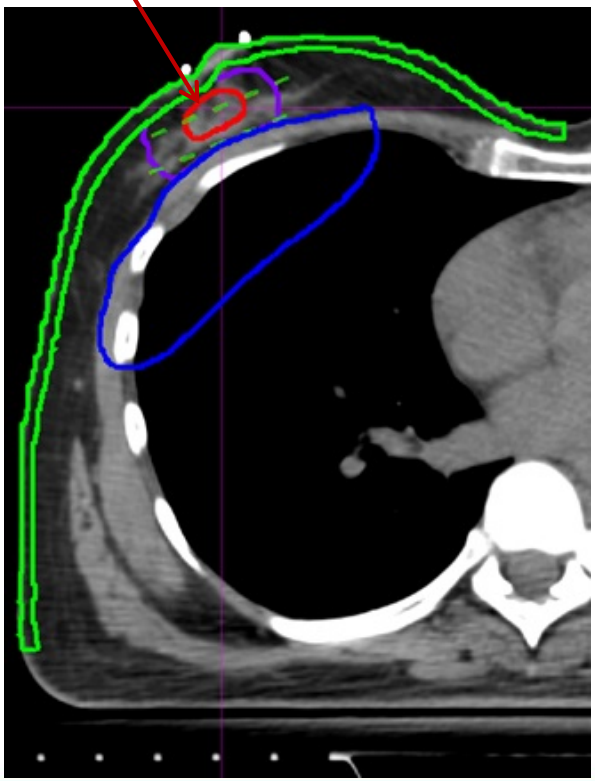


Treated with I125 seeds

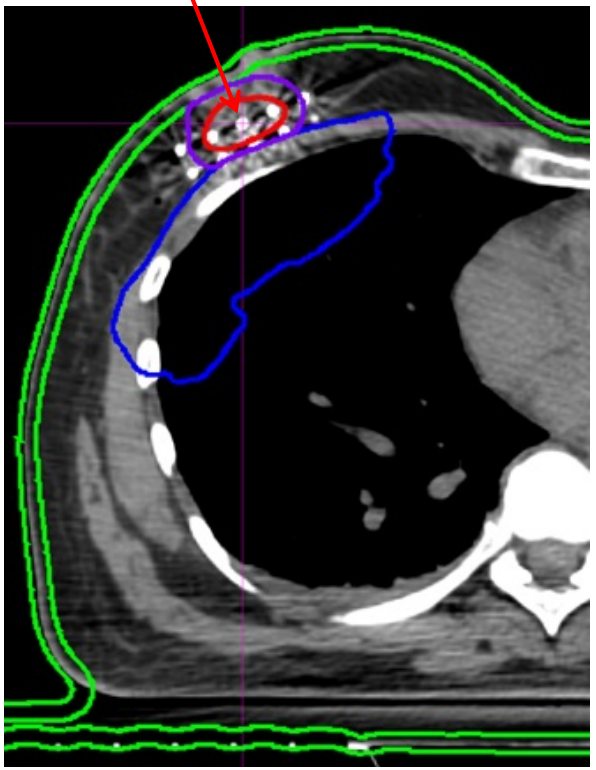


Breast brachy – at TBCC

- Tumor in the breast (surgical cavity)



- Tumor treated with Pd-103 seed the breast



Brachytherapy – at TBCC

Patient released with wallet card

Prostate brachy

Patient Name: _____

Alberta Health Services

Received a permanent radioactive implant of the prostate

Containing I-125 seeds on _____

(Please dispose of card 20 months after above date)

(Medical Physicist)

Tom Baker Cancer Centre

Alberta Health Services

Other side of the card:
For Radiation Safety issues

Mon – Fri (9am – 5 pm) (403) 521-3798

For emergencies, or after hours contact (403) 944-1110

Request to speak with the on-call oncologist

Breast brachy

Patient Name: _____

Alberta Health Services

Received a permanent radioactive implant of the prostate

Containing I-125 seeds on _____

(Please dispose of card 6 months after above date)

(Medical Physicist)

Tom Baker Cancer Centre

Alberta Health Services

Other side of the card:
For Radiation Safety issues

Mon – Fri (9am – 5 pm) (403) 521-3798

For emergencies, or after hours contact (403)444-1110

Request to speak with the on-call oncologist

Brachytherapy – Radiation Safety

- Radioprotection for family members
  - NCRP recommends that the partner's effective dose should be less than 5 mSv/yr

Prostate brachytherapy	Breast brachytherapy
May be less doserate because the depth in tissue at which the seeds are placed	Seeds may have a relatively small amount of tissue covering the implant
Always centrally located	Depending on the seroma location a larger amount of tissue may cover the implant if radiation exposure is measured in the other direction

Brachytherapy – Radiation Safety

	Prostate brachytherapy	Breast brachytherapy
Seeds	I-125	Pd-103
Delivery method	Seeds in cartridge	Preloaded needles
Photon energy	35 keV	21 keV
Activity of each seed	~ 0.5 mCi	~ 1.93 mCi
Half life	59 d	17 d
Patient treated with	60-100 seeds	20 – 100 seeds

Brachytherapy – Radiation Safety

	Prostate brachytherapy	Breast brachytherapy
Seeds	I-125	Pd-103
Shielding	Thin metal foil	Thin metal foil
Critical Organ	Thyroid gland	N/A
Suggested protection if handled ruptured or damaged seeds	Thyroid scan within 72 hours of handling 1 mCi or more or after any suspected intake	N/A

Brachytherapy – Deceased Patient

- Cremation is concern
  - The activity remains in patient ashes
  - Irradiation of crematorium staff and family members
- Airborne dose
  - Inhalation of radioactive particles by cremation staffs, member of the public is also concern

Brachytherapy – Decease Patient

- Cremation is recommended (ICRP 98)
  - I-125 seeds if 12 months elapsed after the date of
  - Pd-103 seeds if 3 months elapsed after the date of implant

  Prior to 12 (3) months it is recommended to remove the organ from the dead body and store the organ (seeds)

- If removing organ is not possible cremation is recommended with special precaution

Brachytherapy – Decease Patient

- According to one publication*
  - if the patient died immediately after the implant the residual activity in the cremated remains are in the range 600-6000 µCi
  - Inhaling 4 µCi or ingestion of 2 µCi of I-125 will translate the radiation dose of 1 mSv

Hence should take a precaution if cremation is needed before the end of 20 months of the date of implantation even though it is recommended after 12 months of implantation

*Radiation safety issues regarding the cremation of the body of an I-125 prostate Implant patient, William Que, Journal of Applied Clinical Medical Physics, Vol 2, issue 3, summer 2001, pages 174-177.

Relevant Regulations - RSO

- No federal and provincial guidelines
  - Once the seeds inserted in the patient and the patient leaves the hospital
  - In the event when patient died with the seeds (radioactive material) within the body.
- RSO receive call requesting guidance
  - Not sure where and how to reach for information
  - How to guide the patient's family, radiation therapy department, funeral home, morgue

Relevant Regulations - RSO

- As a RSO at TBCC dealt with three cases in the last five and half years
  - One of the patient died after 75 days of the treatment and the other two ~ 9 months after the implant

Brachytherapy – Decease Patient

- Instruction for Funeral home

  - Embalming is ok – the staff will not be exposed to any unnecessary exposure when dealing with such deceased as the sources are sealed.
  - If cremating (before 20 months)
    - Wear a respirator with appropriate filter when handling cremated remains
    - Use of rubber/vinyl gloves during handling and washing hands afterwards is recommended
    - Gloves and filter can be surveyed by the radiation safety expert before disposal

Brachytherapy – Radiation safety

- Instruction for Funeral home

  - The cremated remains should not be processed and should put in a metal urn for storage or burial
  - The cremated remains can hand over to the family with the instruction not to scatter in the environment until a minimum of 20 months for I125 and for 6 months for Pd103

Brachytherapy – Radiation safety

- Instruction for Morgue at the Hospital
  - If morgue is removing the prostate of the patient
  - They need the radiation safety support
    - Provide the staff with ring dosimeter
    - The metal container to store the organ
    - The radiation symbol and the date until when to dispose the organ
    - Dispose as regular biohazard waste
    - Follow up when it is time to dispose

Acknowledgement

- Eduardo Villarreal Barajas, PhD, Senior Medical Physicist, TBCC.

Safety Begins with You

Question