CANADIAN UNDERGRADUATE UROLOGY CURRICULUM

Prostate Cancer

A Message from CanUUC

This educational material is intended to supplement medical student knowledge on urological health and medical practices. We are committed to promoting inclusion across all our materials. We acknowledge that some language used within this content may include terminology from source materials and research studies, which has been maintained to reflect the scientific context in which information was gathered.

Wherever possible, we aim to use language that is respectful of all individuals, recognizing gender diversity, variations in sex characteristics, and the importance of inclusive terminology.

Learning Objectives

- Discuss the pros/cons of early detection of prostate cancer.
- Outline the steps of prostate cancer diagnosis.
- Define PSA and discuss the different reasons for a PSA to be elevated.
- Describe basic treatment options for prostate cancer, both early and advanced.
- Discuss the sequalae of advanced prostate cancer, including spinal cord compression.

Prostate Cancer: Statistics

- Most common non-cutaneous malignancy in men in North America.
- 3rd most common cause of cancer-related deaths in males.
- 1 in 8 will be diagnosed.
- Lifetime risk of being diagnosed with prostate cancer is 12.5% but risk of dying of prostate cancer is only 3%.

Prostate Cancer: Risk Factors

Established

- Advancing age
- Presence of androgens
- Family history (1st degree relative)

Potential

- High dietary fat
- Obesity
- Inherited mutations (*BRCA1* or *BRCA2* genes)
- Vitamin D or E deficiency

Prostate Cancer Presentation

Early stages usually **asymptomatic**

- Most cases detected by serum PSA screening
- Palpable nodule or firmness on DRE

Advanced stages

- Urinary retention/renal failure
- Bone pain
- Anemia
- Weight loss, fatigue
- Spinal cord compression

Screening for Prostate Cancer

Goal:

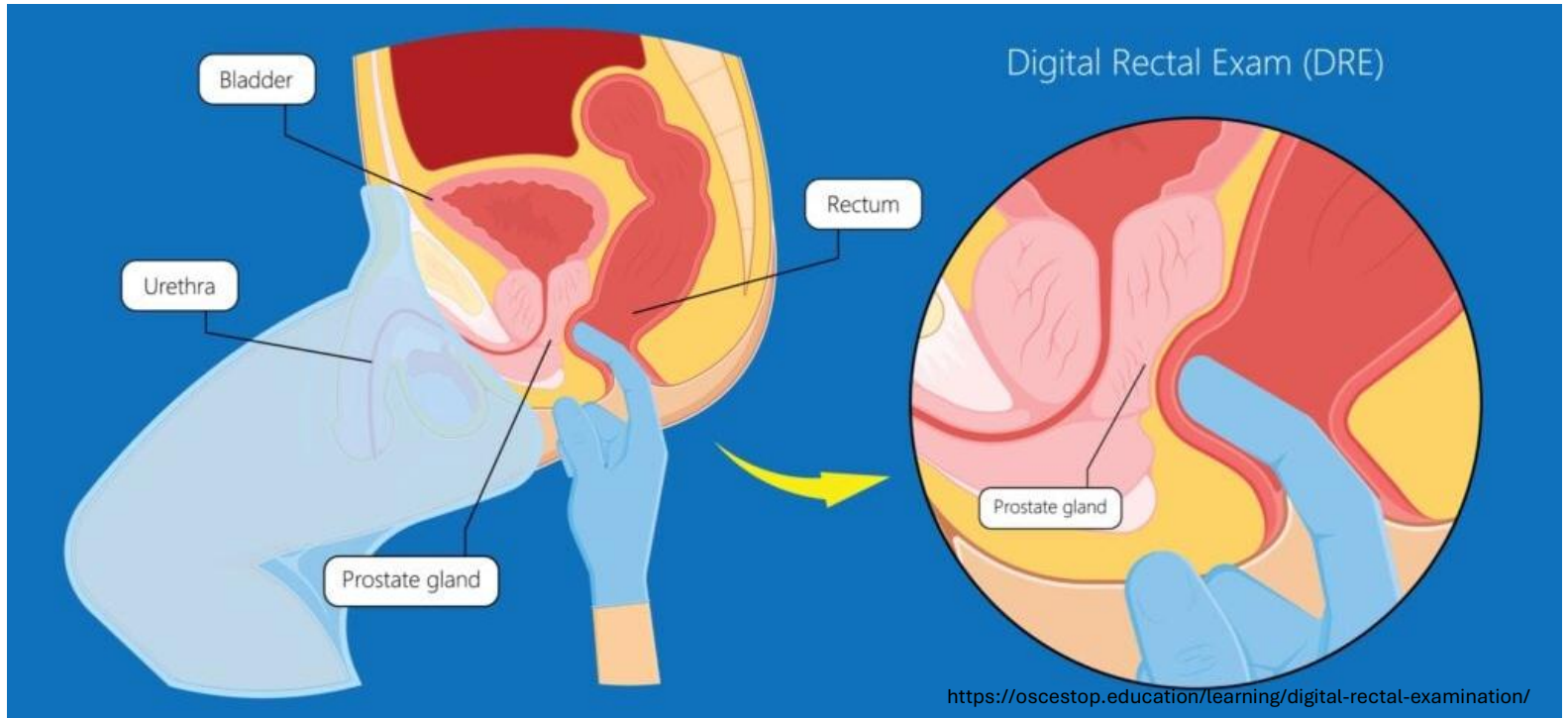
- To identify the presence of disease at a stage when treatment can be given that will cure it

Method:

- Use a combination of DRE and PSA

Digital Rectal Examination

- Digital rectal exam(DRE) has a 50% positive predictive value
- DRE alone is not a good screening tool
- BUT it is an important part of screening



https://oscestop.education/learning/digital-rectal-examination/

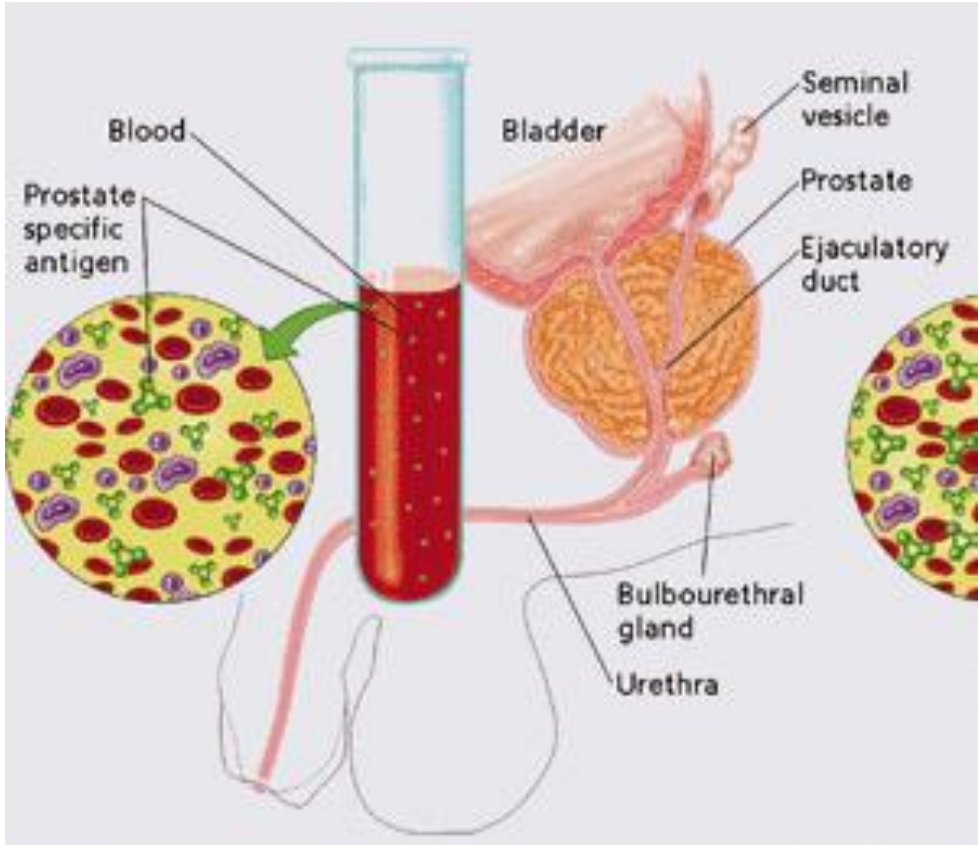
What is Prostate Specific Antigen (PSA)?

A serine protease (enzyme) found in the prostate

PSA is secreted by prostate epithelial cells and found in ejaculate

It is used as a diagnostic tool for:

- Screening
- Staging
- Prognostic indicator
- Surveillance



https://www.healthplexus.net/article/new-psa-based-screening-tests-prostate-cancer

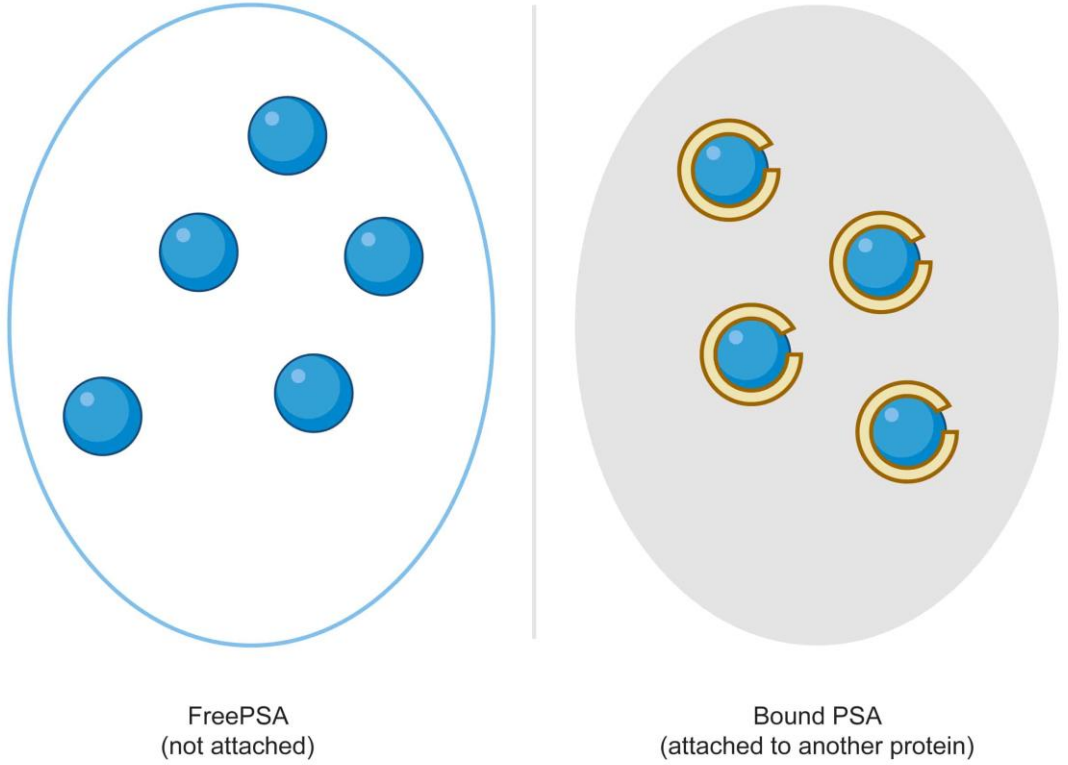
Prostate Cancer: Screening with PSA

- No clear cut-point between normal and abnormal PSA levels.
- **While a single PSA value may arise suspicion, it is important to see the PSA's behaviour over time**
- Positive predictive value for PSA > 4ng/ml = 30%
    - About 1 in 3 with elevated PSA have prostate cancer detected at time of biopsy
- PPV increases to 45-60% for PSA > 10ng/ml
- Nearly 75% of cancers detected in the grey zone (PSA 4-10) are organ-confined; potentially curable.
- <50% of prostate cancers organ-confined if PSA >10

Free/Total PSA Ratio: A Way to Improve Specificity

Prostate cancer may be associated with more protein-bound PSA (less free PSA) than in BPH

- F/T ratio is lower in patients with prostate cancer
- Can improve test specificity
- Useful when total PSA in 4-10 ng/ml range



https://www.prostate.org.au/testing-and-diagnosis/psa-testing/free-to-total-psa-testing/

Causes of an Elevated PSA

1. Prostate cancer
2. Age
3. Prostate size (BPH)
4. Infection/inflammation
5. Recent instrumentation (biopsy, catheterization, etc)
6. Physiological variation (ie: recent ejaculation)

Pros and Cons of Prostate Cancer Screening

Pros

- Early detection of disease leads to higher cure rates
- By the time prostate cancer symptoms present, it's usually not curable
- **Screening offers a modest effect on mortality**
- The "number needed to screen" is similar to studies on mammography for breast cancer and fecal occult blood testing for colon cancer

Cons

- If tests are abnormal, need for prostate biopsy
- If cancer is found and treatment is chosen, morbidity from therapy
- If insignificant cancer is found at time of treatment, treatment was unnecessary
- Risk of overdiagnosis and overtreatment

Screening Recommendations

Discuss with the patient and if they decide to be screened

- Annual PSA and DRE
- Age 50-70 years (with at least 10-year life expectancy)
- Begin screening at age 45 if risk factors
- First degree relative(s) with prostate cancer

A shared decision-making approach to PSA screening is most appropriate

Mason RJ, Marzoik K, Finelli A, et al. UPDATE – 2022 Canadian Urological Association recommendations on prostate cancer screening and early diagnosis: Endorsement of the 2021 Cancer Care Ontario guidelines on prostate multiparametric magnetic resonance imaging.. Can Urol Assoc J 2022;16(4):E184-96. http://dx.doi.org/10.5489/cuaj.7851

Current CUA Screening Pathway

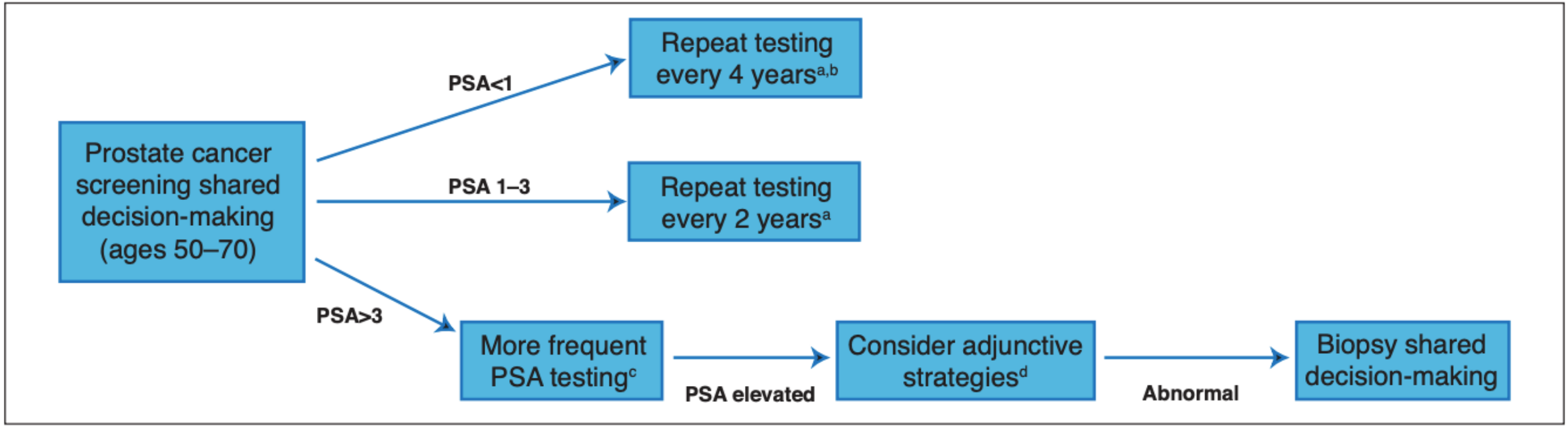


Fig. 1. Prostate cancer screening pathway. [a]Discontinue screening if life expectancy <10 years; [b]consider discontinuation of screening if age >60 and PSA <1 ng/ml; [c]more frequent testing interval can be considered; the optimal frequency is unknown; [d]i.e., risk calculators, % free PSA, etc. PSA: prostate-specific antigen.

Mason RJ, Marzoik K, Finelli A, et al. UPDATE – 2022 Canadian Urological Association recommendations on prostate cancer screening and early diagnosis: Endorsement of the 2021 Cancer Care Ontario guidelines on prostate multiparametric magnetic resonance imaging.. Can Urol Assoc J 2022;16(4):E184-96. http://dx.doi.org/10.5489/cuaj.7851

When to Stop PSA Screening

Consider discontinuing PSA screening based on current PSA level and life expectancy.

a. For patients aged 60 with a PSA < 1ng/ml
b. For patients with a life expectancy under 10 years
c. For all other patients, at age 70

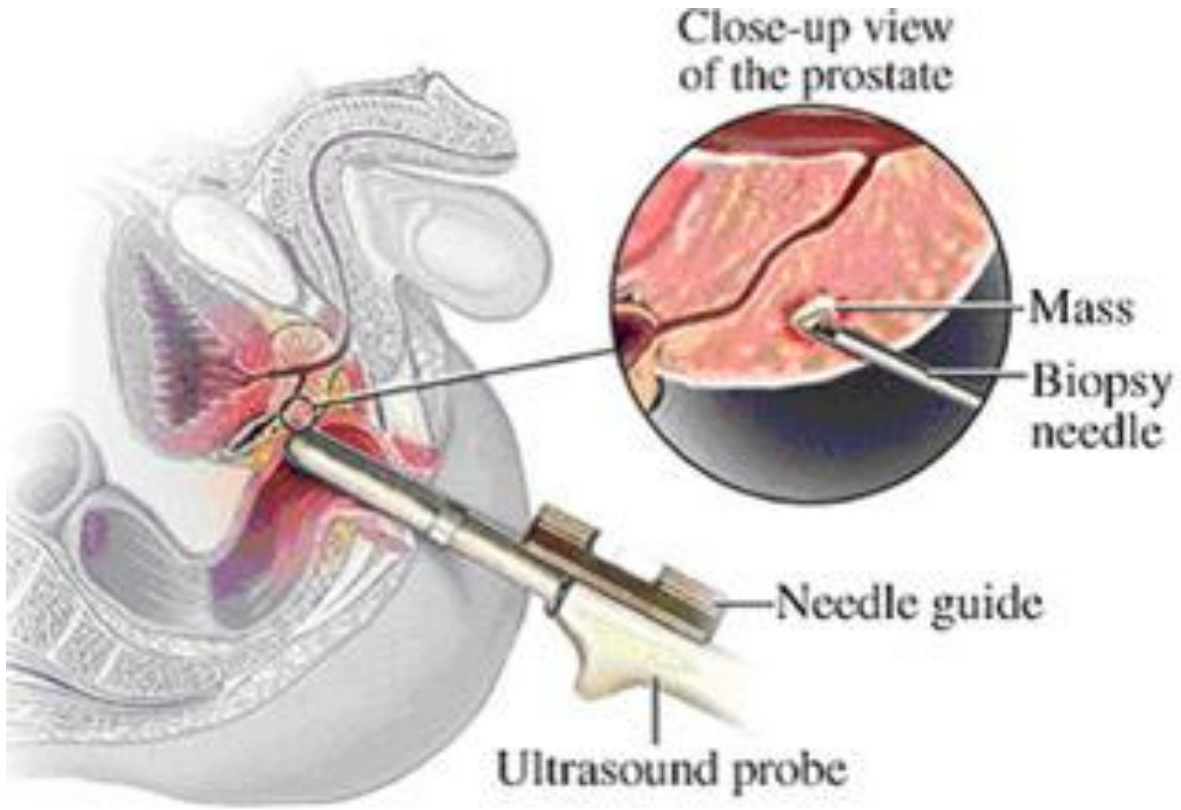
Prostate Cancer Diagnosis

Indications for transrectal ultrasound (TRUS) guided biopsy

- Palpable nodule on DRE
- Elevated serum PSA

Biopsy involves 10-18 needle cores taken mostly from the peripheral zone of the prostate

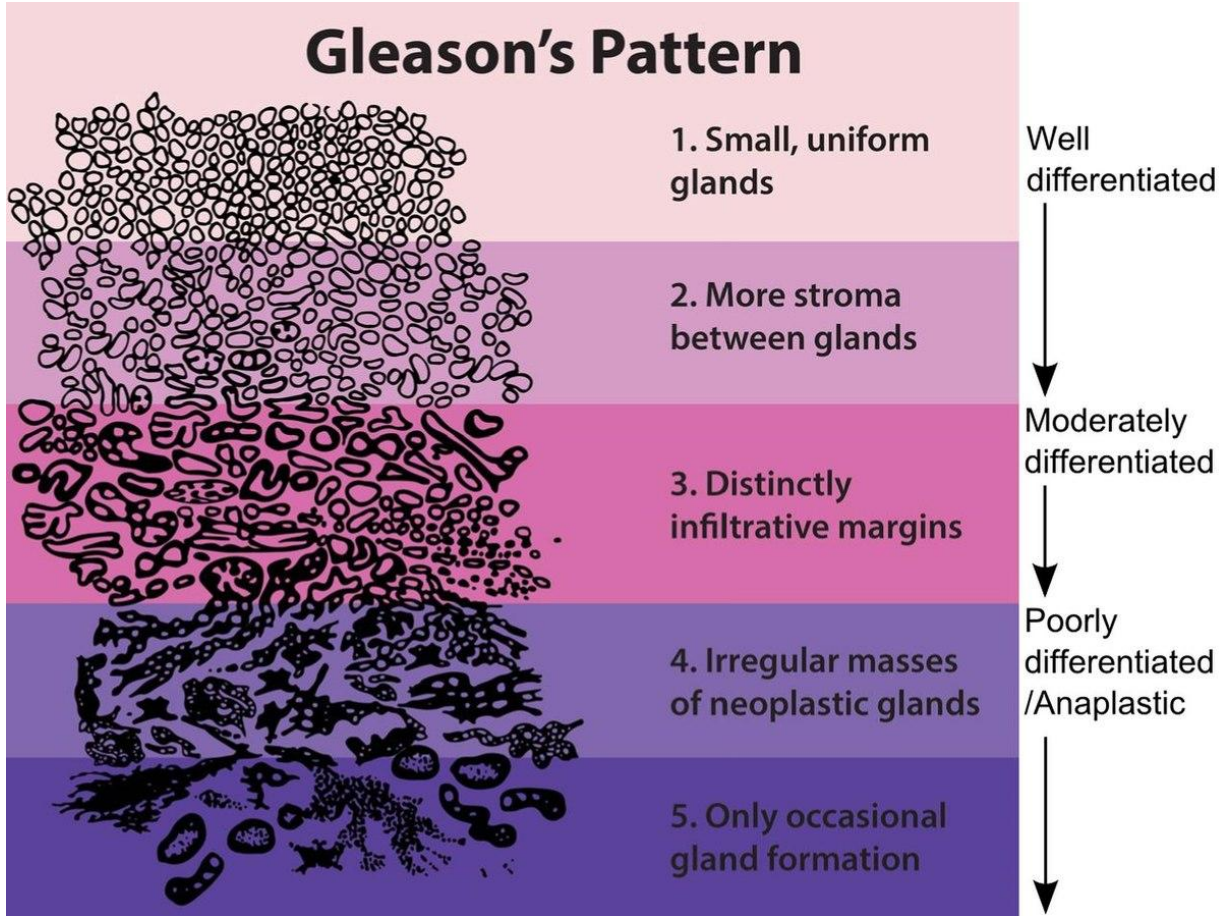
Transrectal ultrasound alone/CT scan/MRI not sensitive enough to make the diagnosis



https://www.drronaldfrank.com/ultrasoundbiopsy.html

Prostate Cancer: Pathology

- Adenocarcinoma
- Gleason “grade” is from 1-5 based on glandular architecture
- Gleason score is the total primary grade (1-5) + secondary grade (1-5) = 2-10
  - 4-6/10 = well-differentiated
  - 7/10 = moderately differentiated
  - 8+/10 = poorly differentiated



Prostate Cancer: Staging

- Can spread to adjacent organs (seminal vesicles, bladder), lymph nodes, bone
- Most bone mets are osteoblastic
- Prior to initiating treatment consider:
    - Bone scan (if PSA>10, Gleason Score >7)
    - CT scan pelvis/abdomen (if PSA >10, Gleason Score >7)
    - These tests are typically not required in asymptomatic patients with low-risk prostate cancer

Prostate Cancer Treatment

Considerations

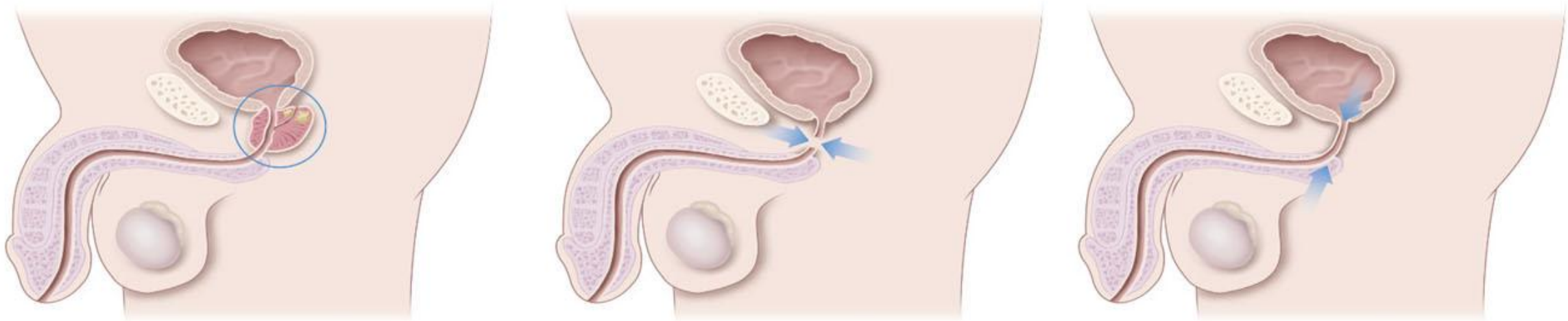
- Patient's age
- Co-morbid health conditions
- Tumor stage
- Tumor grade (Gleason score)
- Patient's weighing the pros and cons of different treatment options

Early-Stage Prostate Cancer Treatment

1. Radical Prostatectomy
2. External Beam Radiotherapy
3. Radioactive Seeds (Brachytherapy)
4. Active Surveillance
5. Observation – Watchful Waiting

Radical Prostatectomy

- Complete surgical removal of entire prostate, seminal vesicles
- Considered a good treatment for patients <75 years of age with clinically organ confined cancer who are healthy
- Open or laparoscopic/robotic approaches



https://www.menshealthtreatments.com.au/understanding-incontinence/prostate-cancer.html

Radical Prostatectomy: Complications

- <10% risk of blood transfusion
    - (<2% if performed robotically)
- Wound infection
- Rectal injury (<1%)
- Urinary incontinence (~10%)
- Erectile dysfunction (variable but common)
- Anaesthetic related

Radiotherapy

Radiotherapy is a curative option for patients at high risk for morbidity from radical prostatectomy based on age, medical comorbidities or patient preference.

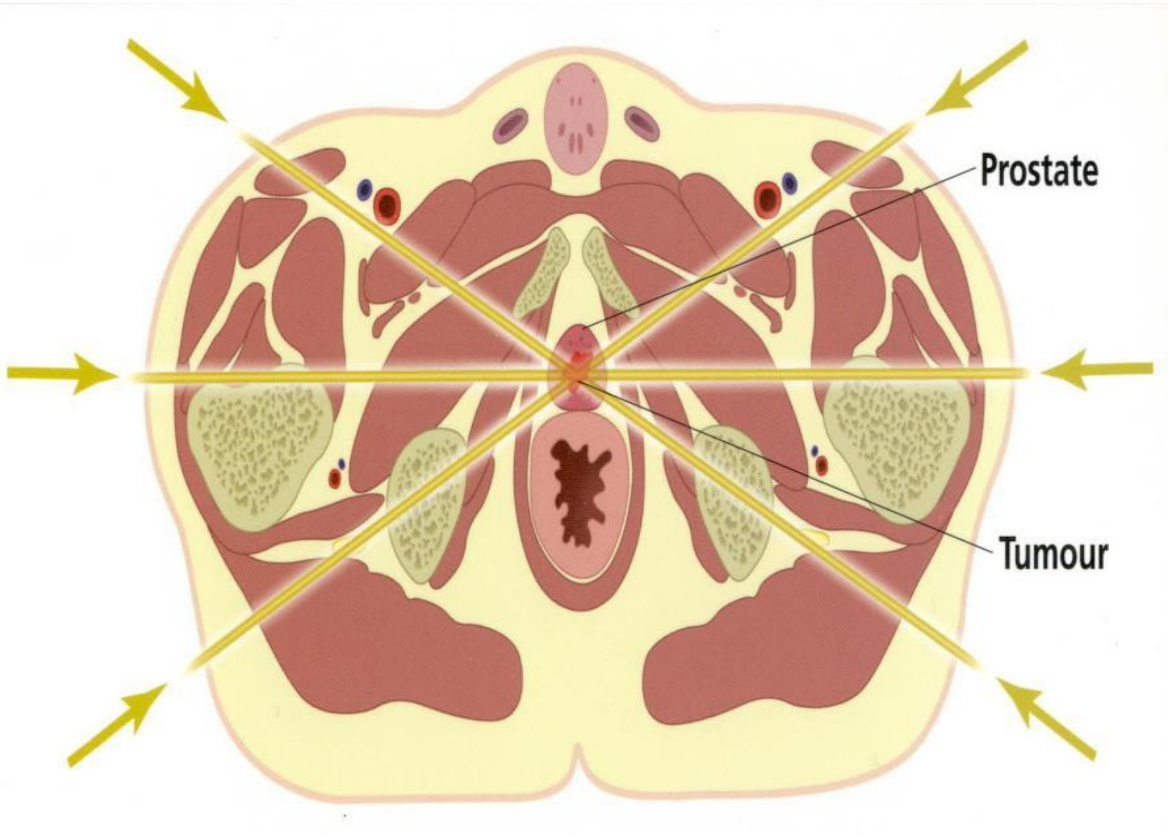
Radiotherapy Options

- External Beam
- Brachytherapy (seed implant)

Goal is to maximize dose to the tumor and minimize collateral damage to other structures.

External Beam Radiotherapy

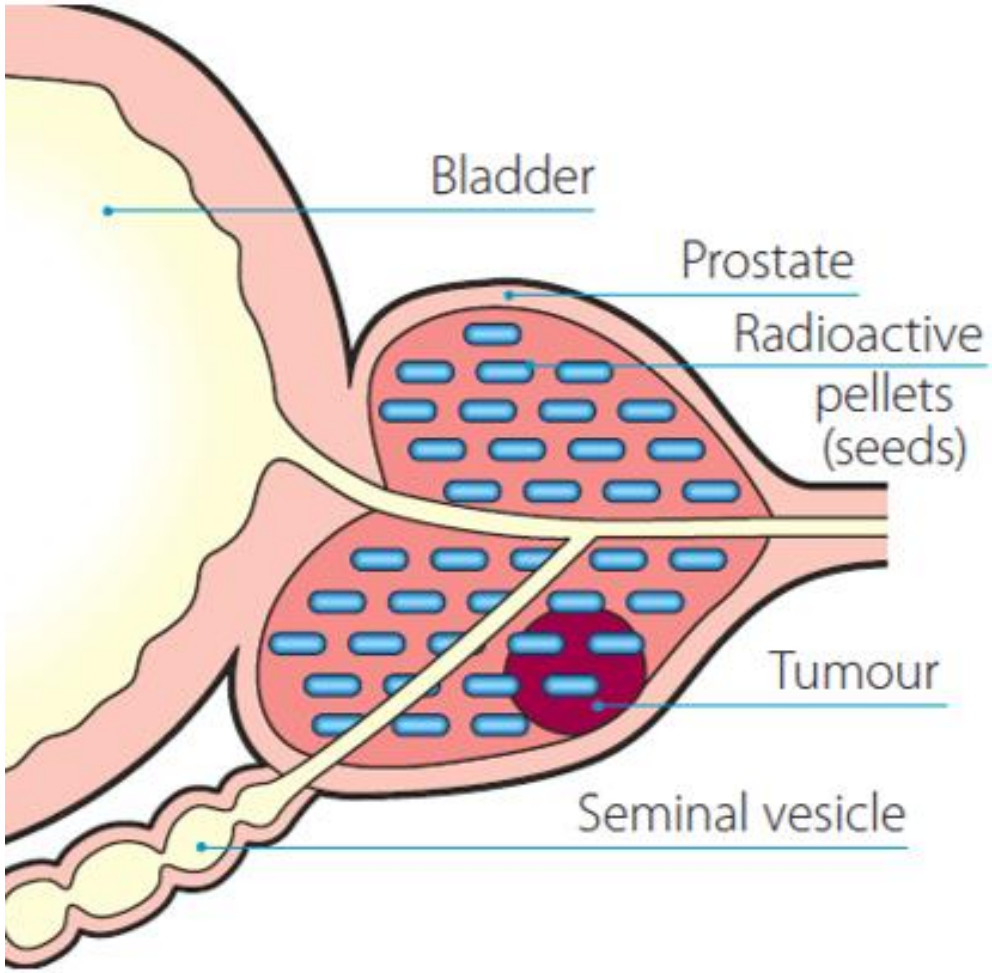
https://www.roswellpark.org/cancertalk/202305/skin-care-tips-radiation-therapy-patients



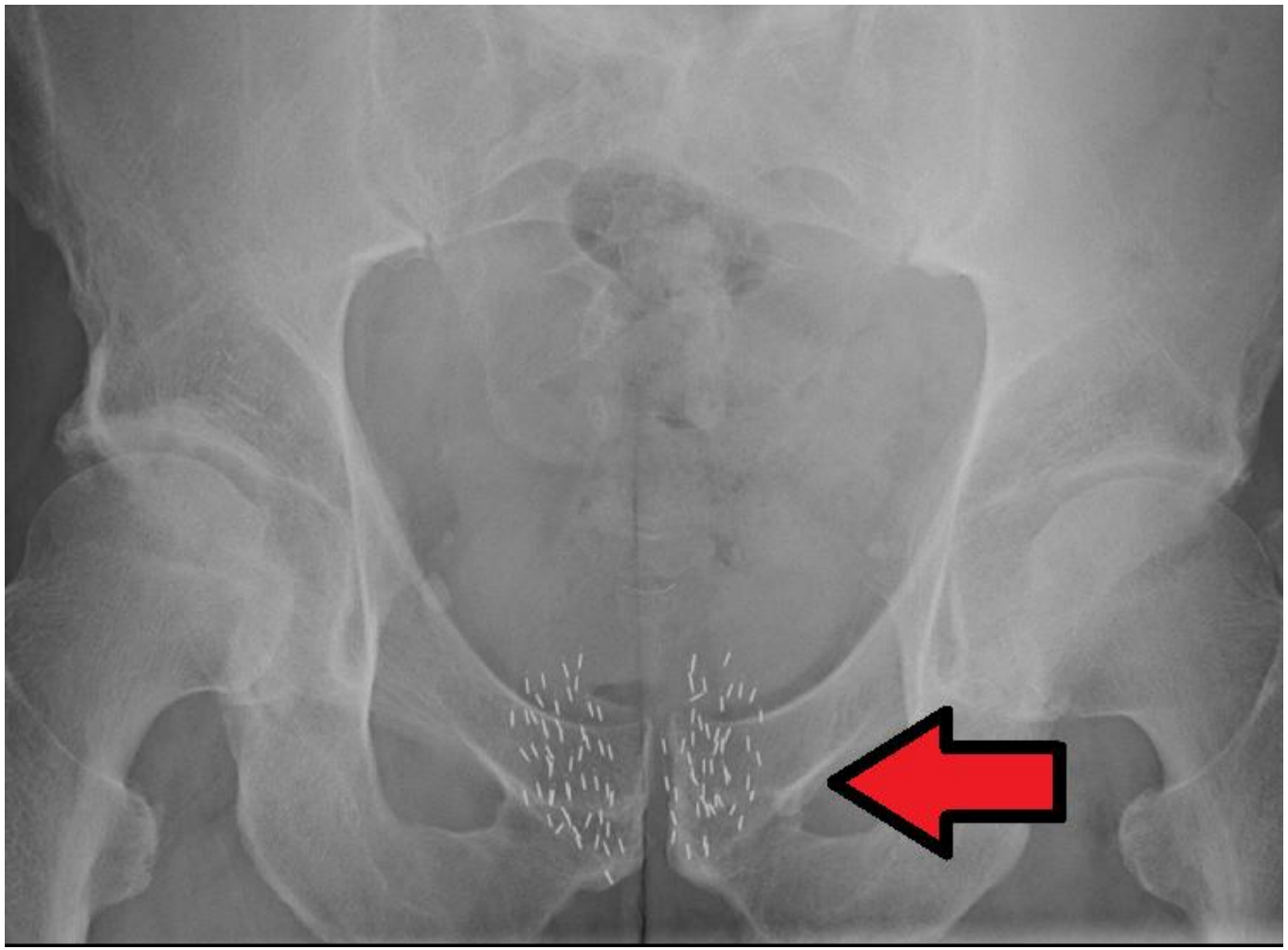
External Beam Radiotherapy: Complications

- Hematuria
- Radiation proctitis
  - Loose, bloody stools
- Urinary retention
- Strictures (urethra and ureter)
- Erectile dysfunction
- Secondary malignancies
  - Bladder, rectal, hematological

Brachytherapy



https://www.cancer.ie/node/6243



By James Heilman, MD - Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=49068263

Brachytherapy: Complications

- Urethral strictures
- Seed migration
- Urinary retention
- Erectile dysfunction
- Irritative voiding symptoms

Active Surveillance

- Observing tumors in patients with >10-year life expectancy
- Delay definitive treatment until it is necessary and cancer is still curable
- Goal is to delay or completely avoid potential treatment- related morbidity
- Monitor DRE, PSA, and periodic repeat biopsy
- Ideal candidate:
  - PSA < 10
  - Normal DRE
  - Gleason <7 (low grade)

Watchful Waiting

- Observing low grade tumors in patients < 10 years life expectancy
- Institute hormonal therapy when patient becomes symptomatic
- No curative intent

Advanced or Metastatic Prostate Cancer

- Not curable disease
- Development of cancer cells unresponsive to androgen deprivation
- Goals shift to disease control and palliation when required – palliation can offer patients significant pain relief and quality of life
- Progression is typically slow but can be rapid

Treating Advanced Prostate Cancer

1. Androgen Deprivation (Hormonal Rx)

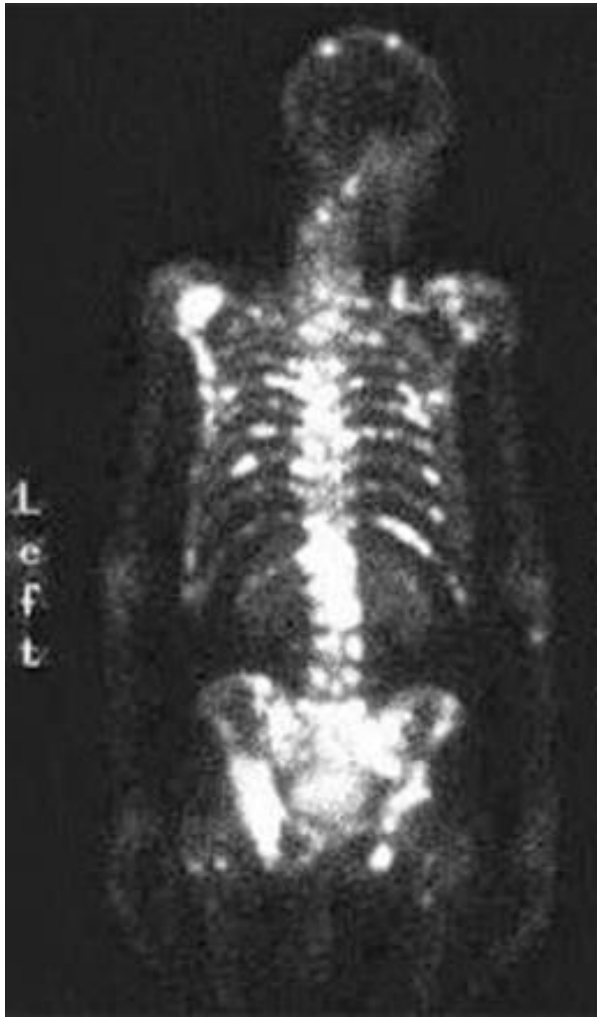
- Orchidectomy
- LHRH analogues
- Antiandrogens and other hormonal adjuncts

2. Supportive therapies

- Analgesics
- Steroids
- Bisphosphonates/Vitamin D/Calcium for bone health

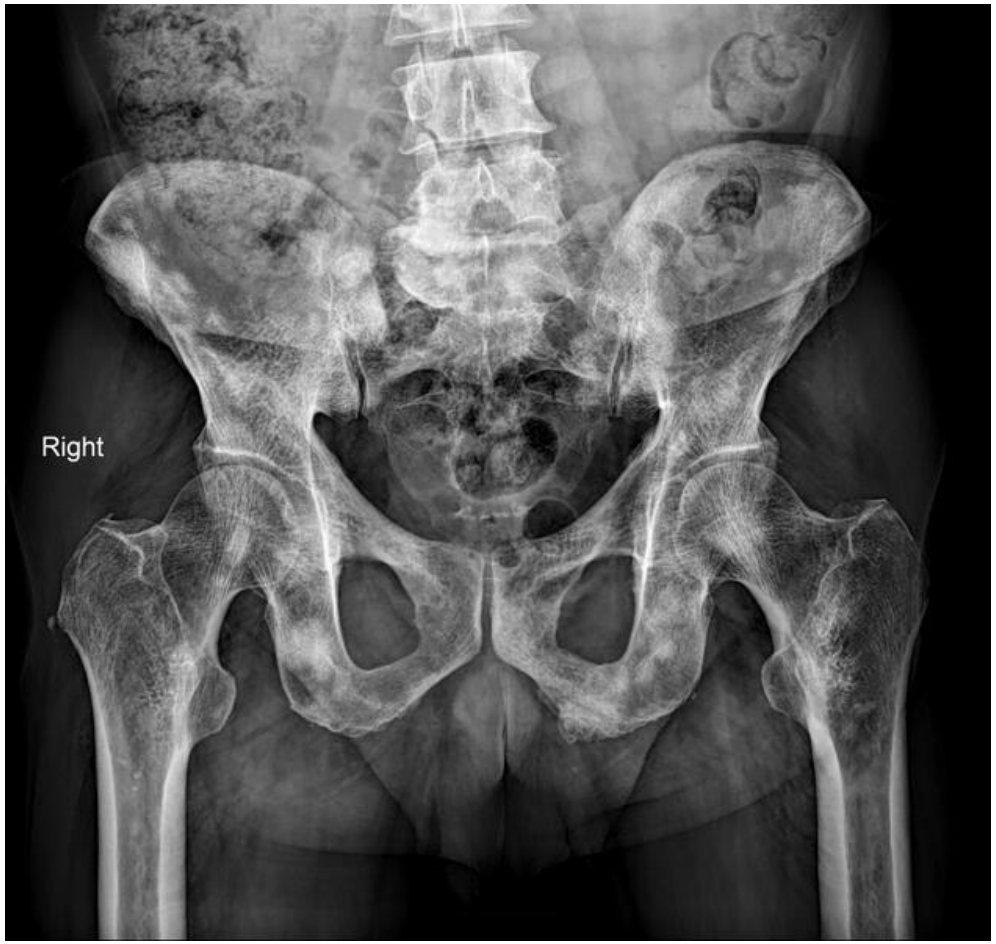
3. Chemotherapy and novel treatments

- Taxotere, Docetaxel
- Evolving role at multiple stages

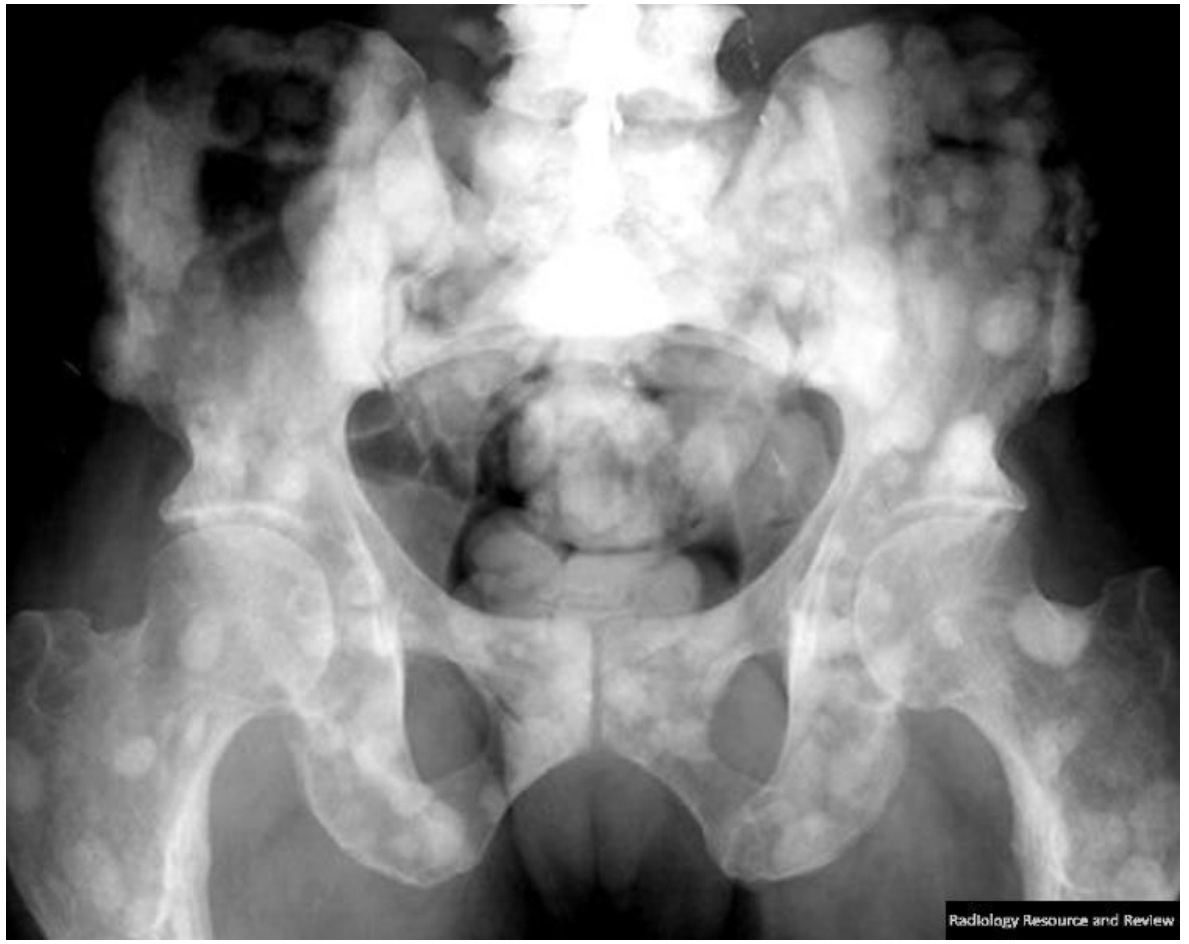


https://reference.medscape.com/features/slideshow/advanced-prostate-cancer

Osteoblastic Bone Metastases



https://radiopaedia.org/cases/osteoblastic-bone-metastases



https://learningradiology.com/archives05/COW%20142-Osteoblastic%20mets/blasticmetscorrect.htm

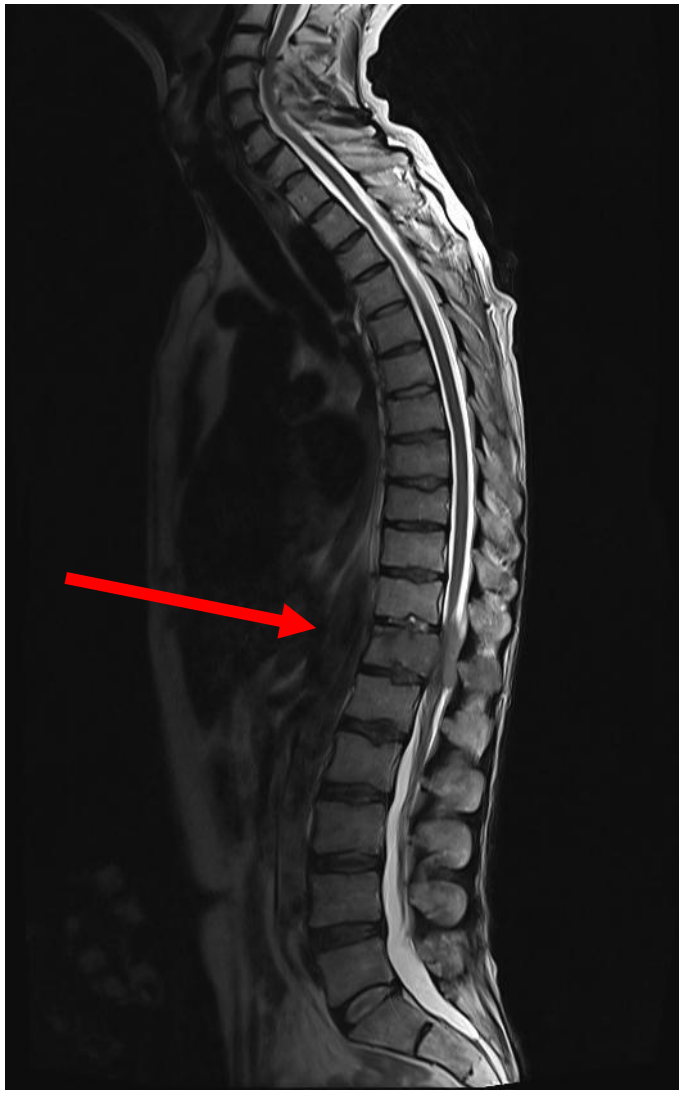
Spinal Cord Compression

Metastatic prostate cancer is a common cause of spinal cord compression.

Clinical recognition is critical.

- Signs and symptoms
  - Back pain
  - Neurological symptoms in saddle distribution
  - Lack of rectal tone, fecal and urinary incontinence
  - Paraplegia below the level of compression

MRI is diagnostic.



https://radiopaedia.org/cases/metastatic-spinal-cord-compression

Spinal Cord Compression

Treatment options:

- Emergency decompression laminectomy by spinal surgeons
- Emergency radiation to affected level
- Dexamethasone/steroids
- Emergency bilateral orchidectomies if patient not already on androgen deprivation.

Prostate Cancer: Prognosis

Early-Stage, Well-Differentiated Prostate Cancer (Post-Radical Prostatectomy):

- Excellent long-term prognosis
- 10-year cancer-specific survival**: 95–100%**
- High likelihood of cure if surgical margins are negative and PSA is undetectable

Metastatic Prostate Cancer:

- Poorer overall prognosis
- 5-year survival: ~30% (based on SEER data)
- Median survival in PEACE 1 trial: **5.72 years**

Prostate Cancer Prevention

Modifiable Factors:

- Diet
  - Saturated fats
  - Red meat
  - BBQ meats
- Lifestyle
  - Exercise
- Drug therapy
  - 5-alpha reductase inhibitor

Prostate Cancer Prevention

- Two major studies using 5-alpha reductase inhibitors vs placebo
  - **Finasteride** (Prostate Cancer Prevention Trial, Thompson et al., 2003)
  - **Dutasteride** (REDUCE Trial, Andriole et al., 2010)
- Similar reduction in prostate cancer diagnosis in the treatment arms (23-24%).
- Not currently approved by Health Canada for prostate cancer prevention.

Prostate Cancer Prevention Challenges

- Most observed benefit is in reducing low-grade (Gleason 6) cancers, which are often indolent and would not require treatment anyway
- Possible increased risk of high-grade prostate cancer with certain interventions (e.g., 5-ARIs)
- High cost of preventive approaches relative to uncertain benefit
- Sexual side effects (e.g., decreased libido, ejaculatory dysfunction) are common and may be irreversible
- Delayed benefit — preventive impact may take 10–20 years to become evident

Prostate Cancer Summary

1. Prostate cancer is the most common non-skin cancer in males, with 1 in 8 will being diagnosed.
2. PSA and DRE are primary screening tools with diagnosis confirmed via TRUS-guided biopsy.
3. Treatment options for localized disease include radical prostatectomy, external beam, brachytherapy, active surveillance, and watchful waiting.
4. Advanced disease management involves androgen deprivation, supportive care, and chemotherapy. Bone metastases and spinal cord compression are key complications requiring urgent attention.
5. Early-stage, organ-confined prostate cancer has >95% 10-year survival; metastatic disease has ~30% 5-year survival and median survival <6 years.
6. Lifestyle factors (diet/exercise) and 5-ARIs may reduce incidence of low-grade cancers.