Prostate Cancer: Current Concepts in Diagnosis, Risk Stratification and Management

Management of Localized Prostate Cancer

Introduction

The management of localized prostate cancer has evolved considerably over the past two decades. Historically, most patients underwent definitive treatment with radical prostatectomy or radiation therapy. However, increasing recognition that many prostate cancers have an indolent natural history has shifted the emphasis toward individualized, risk-adapted management.

Treatment decisions should be based on multiple factors, including:

- Clinical risk category
- Histopathological grade
- PSA level
- MRI findings
- Patient age
- Life expectancy
- Comorbidities
- Baseline urinary and sexual function
- Patient values and preferences

Current international guidelines advocate shared decision-making involving the patient, urologist, radiation oncologist, medical oncologist, and primary care physician.

The principal management options include:

- Active surveillance
- Watchful waiting
- Radical prostatectomy
- External beam radiotherapy
- Brachytherapy
- Focal therapy in selected patients

Principles of Treatment Selection

The primary objectives of treatment are:

- Achieving durable cancer control
- Preventing metastatic progression
- Preserving urinary continence
- Preserving erectile function whenever possible
- Minimizing bowel toxicity
- Maintaining overall quality of life

Life expectancy is a critical determinant of management.

Patients expected to live more than 10 years generally derive greater benefit from definitive treatment, whereas conservative management may be appropriate for older patients with significant comorbidity.

Active Surveillance

Definition

Active surveillance is a structured monitoring programme designed to delay or avoid treatment in men with low-risk disease while maintaining the opportunity for cure should disease progression occur.

It should not be confused with watchful waiting.

The intent remains **curative**, with treatment initiated only if there is objective evidence of progression.

Suitable Candidates

Ideal candidates include men with:

- Grade Group 1 (Gleason score 3+3)
- PSA <10 ng/mL
- Clinical stage T1c–T2a
- Low tumour volume
- Limited number of positive biopsy cores
- PSA density below 0.15 ng/mL/cm^3

Selected patients with favourable intermediate-risk disease (Grade Group 2 with limited pattern 4 disease) may also be considered after careful counselling.

Monitoring Protocol

Although protocols vary slightly among institutions, surveillance usually includes:

- PSA measurement every 3–6 months
- Digital rectal examination every 6–12 months
- Repeat multiparametric MRI
- Confirmatory biopsy within 12–18 months
- Repeat biopsy every 2–4 years or when clinically indicated

MRI has significantly reduced the need for frequent repeat biopsies in many surveillance programmes.

Indications for Definitive Treatment

Treatment should be considered when there is evidence of disease progression, including:

- Upgrading to Grade Group ≥2
- Increased tumour volume
- MRI progression
- Rapid PSA doubling time
- Clinical stage progression
- Patient preference

Advantages

Active surveillance offers several important benefits:

- Avoidance of unnecessary treatment
- Preservation of urinary continence
- Better preservation of erectile function
- Improved quality of life
- Reduced healthcare costs
- Lower treatment-related morbidity

Long-term studies have demonstrated prostate cancer-specific survival rates exceeding 98% at 10–15 years among carefully selected patients.

Limitations

Potential disadvantages include:

- Anxiety associated with untreated cancer
- Requirement for lifelong follow-up
- Repeat MRI examinations
- Repeat biopsies
- Small risk of delayed treatment of aggressive disease

Appropriate patient selection remains the key determinant of success.

Watchful Waiting

Watchful waiting differs fundamentally from active surveillance.

The objective is **symptom control rather than cure**.

This approach is generally appropriate for:

- Elderly men
- Patients with significant frailty
- Limited life expectancy
- Multiple serious comorbidities

Patients receive palliative treatment only if symptoms develop from local progression or metastatic disease.

Radical Prostatectomy

Overview

Radical prostatectomy remains one of the standard curative treatments for localized prostate cancer.

The operation involves complete removal of:

- Prostate gland
- Seminal vesicles

- Vas deferens
- Selected pelvic lymph nodes when indicated

The procedure may be performed using open, laparoscopic, or robot-assisted techniques.

Robot-Assisted Radical Prostatectomy

Robot-assisted surgery has become the preferred approach in many centres.

Advantages include:

- Excellent visualization
- Reduced blood loss
- Lower transfusion rates
- Shorter hospital stay
- Faster postoperative recovery
- Smaller incisions
- Less postoperative pain

Long-term cancer outcomes are comparable with open surgery when performed by experienced surgeons.

Nerve-Sparing Surgery

Preservation of the neurovascular bundles is desirable whenever oncologically safe.

Suitable candidates include men with:

- Organ-confined disease
- Good baseline erectile function
- Low likelihood of extracapsular extension

Successful nerve preservation significantly improves postoperative erectile function without compromising cancer control in appropriately selected patients.

Pelvic Lymph Node Dissection

Pelvic lymph node dissection provides the most accurate assessment of nodal involvement.

It is generally recommended for patients with:

- High-risk disease
- Selected intermediate-risk disease
- Significant predicted risk of lymph node metastases

Extended lymph node dissection provides superior staging compared with limited dissection.

Complications of Radical Prostatectomy

Early Complications

Potential perioperative complications include:

- Bleeding
- Infection
- Urinary leak
- Deep vein thrombosis
- Pulmonary embolism
- Lymphocele
- Ileus
- Anastomotic leak

Overall perioperative mortality is very low in experienced centres.

Long-Term Complications

Urinary Incontinence

Stress urinary incontinence remains one of the most important complications.

Most patients gradually recover continence over 6–12 months.

Persistent severe incontinence occurs in a minority of patients and may require:

- Pelvic floor rehabilitation
- Male sling
- Artificial urinary sphincter

Erectile Dysfunction

Postoperative erectile dysfunction results primarily from injury to the cavernous nerves.

Recovery depends upon:

- Age
- Baseline erectile function
- Extent of nerve preservation
- Cardiovascular health
- Diabetes mellitus

Penile rehabilitation strategies may include:

- Phosphodiesterase-5 inhibitors
- Vacuum erection devices
- Intracavernosal injections
- Penile prosthesis surgery

Infertility

Because the seminal vesicles and vas deferens are removed, radical prostatectomy results in permanent loss of ejaculation.

Men wishing to preserve fertility should receive counselling regarding sperm banking before treatment.

Radiation Therapy

Radiotherapy provides excellent long-term cancer control and represents an alternative to surgery for most men with localized disease.

Treatment selection depends upon:

- Risk category
- Age
- Comorbidities
- Urinary symptoms
- Patient preference

External Beam Radiotherapy (EBRT)

Modern EBRT uses highly conformal treatment planning to maximize tumour dose while minimizing radiation exposure to surrounding organs.

Technological advances include:

- Intensity-modulated radiotherapy (IMRT)
- Image-guided radiotherapy (IGRT)
- Volumetric-modulated arc therapy (VMAT)
- Stereotactic body radiotherapy (SBRT)

These techniques have significantly reduced treatment-related toxicity.

Hypofractionation

Increasing evidence supports moderately hypofractionated schedules, which deliver larger daily doses over fewer treatment sessions.

Advantages include:

- Greater convenience
- Reduced healthcare costs
- Comparable tumour control
- Similar toxicity profiles

Ultra-hypofractionated stereotactic radiotherapy is increasingly used in selected patients.

Brachytherapy

Brachytherapy delivers radiation directly within the prostate.

Low-Dose Rate (LDR)

Permanent radioactive seeds are implanted into the gland.

Ideal candidates include:

- Low-risk disease
- Selected favourable intermediate-risk patients

High-Dose Rate (HDR)

Temporary radioactive sources are inserted through transperineal catheters under image guidance.

HDR brachytherapy is frequently combined with EBRT in higher-risk disease.

Radiation Toxicity

Acute Toxicity

Common acute adverse effects include:

- Increased urinary frequency
- Dysuria
- Urgency
- Mild haematuria
- Rectal irritation
- Fatigue
- Loose stools

Most symptoms resolve within weeks after treatment.

Late Toxicity

Late complications may include:

- Radiation cystitis
- Radiation proctitis
- Rectal bleeding
- Erectile dysfunction
- Urethral stricture
- Rare secondary pelvic malignancies

Modern planning techniques have substantially reduced severe toxicity.

Surgery Versus Radiation Therapy

Numerous comparative studies demonstrate similar long-term cancer-specific survival for appropriately selected patients.

Differences primarily involve side-effect profiles.

Outcome	Radical Prostatectomy	Radiation Therapy
Hospital admission	Yes	Usually outpatient
Immediate recovery	Longer	Shorter
Urinary incontinence	More common initially	Less common
Erectile dysfunction	Immediate onset	Gradual onset
Bowel symptoms	Uncommon	More frequent
Surgical pathology available	Yes	No

The optimal treatment depends on informed patient preference following multidisciplinary counselling.

Focal Therapy

Interest in focal therapy has increased because many prostate cancers are localized to a dominant lesion.

Techniques include:

- High-intensity focused ultrasound (HIFU)
- Cryotherapy
- Irreversible electroporation
- Laser ablation
- Photodynamic therapy

Potential advantages include:

- Reduced urinary morbidity
- Better preservation of erectile function
- Shorter recovery time

However, long-term oncological outcomes remain less well established than surgery or radiotherapy.

Consequently, focal therapy is currently recommended only for carefully selected patients, preferably within experienced centres or clinical trials.

Management According to Risk Category

Low-Risk Disease

Preferred management:

- Active surveillance

Alternative options:

- Radical prostatectomy
- External beam radiotherapy
- Brachytherapy

Favourable Intermediate-Risk Disease

Treatment options include:

- Active surveillance in selected patients
- Radical prostatectomy
- EBRT
- Brachytherapy

Unfavourable Intermediate-Risk Disease

Recommended approaches include:

- Radical prostatectomy with pelvic lymph node assessment
- EBRT combined with 4–6 months of androgen deprivation therapy
- EBRT with brachytherapy boost in selected patients

High-Risk Localized Disease

Management generally requires multimodal therapy.

Options include:

- Radical prostatectomy with extended pelvic lymph node dissection
- EBRT plus long-term androgen deprivation therapy (18–36 months)
- EBRT with brachytherapy boost plus ADT

Patients should be managed within a multidisciplinary team whenever possible.

Salvage Therapy Following Primary Treatment

Biochemical recurrence may occur following definitive therapy.

Following Radical Prostatectomy

Biochemical recurrence is defined as:

- PSA ≥0.2 ng/mL confirmed by a second measurement.

Early salvage radiotherapy provides better outcomes than delayed treatment.

Following Radiation Therapy

Biochemical recurrence is defined using the Phoenix definition:

- PSA rise ≥2 ng/mL above the post-treatment nadir.

PSMA PET/CT has become the preferred imaging modality for evaluating recurrence at low PSA levels.

Quality of Life

Successful prostate cancer management extends beyond tumour control.

Clinicians should routinely assess:

- Urinary continence
- Sexual health
- Bowel function
- Mental health
- Relationship issues
- Fatigue
- Physical activity
- Bone health
- Patient-reported outcome measures

Early referral to physiotherapists, continence specialists, sexual health clinicians, psychologists, and survivorship programmes can significantly improve long-term outcomes.

Key Practice Points

- Active surveillance is the preferred management strategy for most men with low-risk localized prostate cancer.
- Radical prostatectomy and radiotherapy provide equivalent long-term cancer control for appropriately selected patients.
- Robot-assisted surgery has become the dominant surgical approach in many centres.
- Modern radiotherapy techniques have reduced treatment-related toxicity while maintaining excellent oncological outcomes.
- High-risk localized disease frequently requires multimodal therapy combining local and systemic treatment.
- Shared decision-making and attention to quality of life are central to contemporary
- prostate cancer management.

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