Prostate cancer is the most common visceral neoplasm diagnosed in the United States and has gained significant public awareness over the past 20 years as a result of the serum prostate-specific antigen (PSA) screening test. Though there is potentially wide variability in presentation, most patients are diagnosed with organ-confined disease. Treatments for localized prostate cancer include surgery, radiation, and active surveillance. One of the newer surgical modalities is robotic-assisted laparoscopic prostatectomy, which has shown promise in improving cancer control and reducing the morbidity commonly associated with open radical prostatectomy. This article will discuss screening and treatment options for localized prostate cancer, with special focus on robotic prostatectomy and its advantages.


Key words: robotics, prostate cancer, laparoscopy

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The urologist performs a prostate biopsy under trans-rectal ultrasound guidance. If prostate cancer is found, further staging work-up may include CT scan of the abdomen/pelvis and a bone scan, depending on the aggressiveness and volume of cancer found on biopsy. A clinical stage can then be assigned based on these studies plus the biopsy findings, DRE, and PSA.

**Treatment**

As discussed earlier, most patients are now diagnosed in the early stages of the disease, when the cancer is still organ-confined. There are 3 major treatment options to consider: active surveillance, radiation, or surgery. (Metastatic disease, generally treated with androgen deprivation therapy and chemotherapy, is beyond the scope of this article.)

**Active surveillance**

According to some reports, 30% to 50% or more of prostate cancer cases in older men are overdiagnosed, meaning that these cancers would not have been detected without screening and would never cause harm to the patient. Because of this, patients with low-grade, low-stage disease and a life expectancy of less than 10 years may be offered an active surveillance protocol consisting of close monitoring with DRE and serum PSA every 3 to 6 months and prostate biopsy every 1 to 2 years. Any evidence of disease progression warrants definitive treatment. This approach is still largely investigational when applied to younger men. It is important to keep in mind that treatment is more likely to be successful if it is given earlier while the tumor is smaller and the prospects for potency-sparing surgery are greater.

**Radical prostatectomy**

Surgery is considered the 'gold standard' for patients with organ-confined disease and greater than 10 years life expectancy. There are now several surgical approaches: perineal, open retropubic radical, laparoscopic radical, and robotic-assisted laparoscopic radical. The open retropubic approach dominated as the most common type of surgery for prostate cancer after the anatomic nerve-sparing technique was described by Walsh in the early 1980s and until the popularity of the robotic approach overtook it in the middle of this decade.

The 3 goals of successful radical prostatectomy in descending order of importance are cancer control (margins), urinary continence, and potency.

**Why prostatectomy?**

Following are important points regarding prostatectomy for both patients and physicians alike to keep in mind:

- It is the only option that removes the entire prostate, whereas other options leave viable tissue and possible cancer behind.
- Surgery is the only option that provides accurate staging, volume, tumor grade, and margins.
- Rates of both upgrading (higher Gleason grade found on the final pathology than on biopsy) and upstaging (higher pathological stage than initial clinical stage) are approximately 30% each after prostatectomy; the true pathology would be otherwise unknown if radiotherapy was given. (Figure 1)

- Follow-up is straightforward. PSA should be undetectable follow-

![Figure 1 Preoperative vs. postoperative Gleason score](https://www.geri.com)

**Gleason score**

<table>
<thead>
<tr>
<th>Gleason Score</th>
<th>Pre-surgery (%)</th>
<th>Post-surgery (%)</th>
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<tbody>
<tr>
<td>6</td>
<td>72%</td>
<td>28%</td>
</tr>
<tr>
<td>7</td>
<td>20%</td>
<td>80%</td>
</tr>
<tr>
<td>8</td>
<td>6%</td>
<td>94%</td>
</tr>
<tr>
<td>9</td>
<td>2%</td>
<td>98%</td>
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Created for Geriatrics by authors
Data determined by authors
ing a prostatectomy with negative surgical margins. PSA continues to be produced following radiation and is difficult to interpret.

- There is no risk of a secondary iatrogenic malignancy developing after radiation.

**History**

Retropubic radical prostatectomy (RRP) was first reported by Millin in 1947. The surgery was associated with significant morbidity: high blood loss often requiring transfusion, incontinence, impotence, and a prolonged recovery. In the early 1980s Walsh described a new, more precise nerve-sparing technique of anatomical dissection that improved functional outcomes. Schuessler performed the first laparoscopic radical prostatectomy (LRP) in 1991; the technique was later refined and popularized by Guillouneau and others in the late 1990s. It has since been demonstrated to be safe, effective, and similar to RRP in oncologic outcomes. LRP provided the benefits of decreased blood loss (secondary to the increased abdominal pressure of the pneumoperitoneum and better visualization) and a minimally invasive approach but remained a technically challenging operation with a steep learning curve and poor ergonomics.

Robotic-assisted laparoscopic prostatectomy (RALP) was first reported by Abbou et al in 2000. It was popularized by Menon et al as a minimally invasive technique with vastly improved ergonomics and shorter learning curve relative to LRP. In particular, RALP offered 3-dimensional stereoscopic visualization and intuitive finger-controlled movements with range of motion surpassing that of the human hand. Robotic prostatectomy is now beginning to surpass both open and laparoscopic approaches in outcomes as robotic surgeons become more proficient.

**Why the robotic approach?**

The robotic approach has developed because there is still substantial room for improving important outcomes after open surgery. Urologists continue to seek ways to refine prostatectomy techniques. However, the robotic revolution is also patient-driven. Patients continue to seek out minimally invasive surgical approaches, hoping to minimize surgical trauma. Though robotic equipment is expensive, and a high surgery volume is necessary to make the purchase and maintenance of a robot cost-effective, the fact is, robotic prostatectomy is now by far the dominant surgical approach to prostate cancer, and its popularity continues to rise. A learning curve of approximately 50 to 100 cases must be overcome before a level of efficiency can be obtained that will achieve financial viability. Furthermore, the importance of a dedicated, trained robotic OR team cannot be overemphasized. Steinberg et al examined the costs of overcoming the learning curves in robotic prostatectomy series reported in the literature and concluded that RALP may be best suited to high volume prostatectomy centers.

Robotic vs. pure laparoscopy

Surgeons who already have advanced laparoscopic skills may have no better results with the robot. That being said, the robot provides several advantages for most surgeons: more procedural control, better vision, greater wrist flexibility, suturing facility, instrument stability, and surgeon comfort.

Robotic vs. open

Both laparoscopic approaches are considered less invasive than the traditional open prostatectomy. There are other considerations for RALP:

- Though long-term oncologic efficacy data are as yet lacking for RALP, in series reported by experienced surgeons positive margin rates are usually improved compared to the open approach. For example, Smith et al noted a positive margin rate of 15% compared to a rate of 35% for the open approach. It should be noted, however, that patients in their open prostatectomy series had an overall higher risk profile (higher Gleason scores, PSA values, etc.), thereby possibly confounding the positive margin rates.

- A common criticism of robotic surgery is that the lack of tactile feedback inherent to using the robot compromises the surgeon’s ability to judge whether cancer has breached the prostatic pseudocapsule and therefore diminishes cancer control. To counter this claim, many robotic surgeons point out that the superb visualization (11x magnification and 3-dimensional view) more than compensates for this, and in fact, the current literature demonstrates improved positive surgical margin rates for robotic series, as mentioned above.
With regards to postoperative complications, incidences are mostly similar, with the exception of a very low bladder neck contracture rate with the robot (<1%).

Many studies have reported less postoperative pain with the robotic approach.

Blood loss is unquestionably less. Farnham et al\(^8\) noted a 3% transfusion rate for open surgery and a <1% for robotic; also noted was a median discharge hematocrit of 33% vs. 38%, respectively. This is an especially important point when dealing with patients who refuse blood transfusions, such as Jehovah’s Witnesses. (Figure 2)

OR time has in most series been slightly longer for robotic, with more experienced robotic surgeons having shorter OR times. Our mean operative time is 127 minutes. (Figure 3)

Length of stay is typically less for robotic prostatectomy. Nelson et al\(^17\) reported a 95% rate of discharge after one hospital day vs. 82% for open surgery.

Contidence: Smith et al demonstrated a faster return to continence in 3 months, but by 12 months the difference was less marked (94% vs. 97%).

Potency: Bilateral nerve-sparing radical prostatectomy is now the standard of care for localized disease with no evidence of extracapsular extension or frank involvement of the neurovascular bundles. Continued improvements in robotic technique, including eliminating the use of cautery during the dissection of the neurovascular bundles, have improved potency rates. Potency rates at one year are mostly in the range of 70% to 90%, though some have reported potency as high as 97%.\(^18,20,13\)

Though recent articles have pointed out lower satisfaction rates and higher regret amongst patients who have undergone RALP compared to open prostatectomy, authors have also pointed out that these findings may be due to inappropriate expectations of the new procedure.\(^21\)

Radiation therapy

There are two main types of radiation therapy: external beam and brachytherapy (radioactive seed implantation). Delivery of external beam radiation continues to be refined to minimize surrounding tissue damage and maximize the radiation dose to the prostate. Intensity-modulated radiation therapy (IMRT) and proton radiation therapy are essentially variations on this theme, but their availability is currently somewhat limited due to cost and/or complexity.

With brachytherapy, radioactive seeds or needles are implanted directly into the prostate gland using ultrasound guidance to deliver a high dose of radiation to the tumor. Brachytherapy is relatively easy to perform and therefore has become popular for treatment of patients with clinically localized prostate cancer, but it is seldom used for the treatment of high-volume, high-risk prostate cancers. Urinary symptoms are more common after brachytherapy than after external beam radiotherapy, especially in patients with prostatic hyperplasia.

Both treatments result in acute symptoms of proctitis or cystitis in approximately one third of patients; 5% to 10% develop permanent disorders related to bowel, bladder, and/or urethral function. Approximately half of patients develop erectile dysfunction, depending on age and preoperative erectile function.

Patients with a high PSA level, high Gleason score, or large-volume tumor may benefit from androgen deprivation therapy in conjunction with radiotherapy or the combination of brachytherapy and external-beam radiation.

It is important to note that there have been numerous studies documenting increased risk of secondary bladder and rectal malignancies after radiation therapy.
for prostate cancer,22-24 the most recent of which examined patients diagnosed and treated within the PSA era.25

Other treatments
Primary androgen deprivation therapy may be appropriate for older men, those with significant medical comorbidities precluding the use of curative therapy, or those who do not wish to undergo curative therapy. It is never curative, and remissions are not infrequent.

Cryotherapy has been established as an appropriate and effective modality for recurrent, organ-confined prostate cancer after radiation,26 though its role as a primary modality is still controversial and rates of erectile dysfunction following treatment remain high (up to 80%).

High-intensity focused ultrasound (HIFU), though gaining popularity, remains experimental and is currently not FDA-approved in the United States. Furthermore, the small studies done in Japan and Europe have very short follow-up.

Stereotactic radiotherapy (Cyberknife®) is being used at some centers but is still investigational as efficacy data is lacking.

Follow-up after treatment for prostate cancer
Follow-up for patients who have received radiation therapy is difficult due to the fact that PSA usually does not decrease to undetectable levels and only reaches its nadir approximately 18 months after treatment has been given. There are guidelines set forth by the American Society for Therapeautic Radiology and Oncology but there is still substantial room for interpretation as to what constitutes an abnormal PSA after primary radiation therapy for prostate cancer.

In contrast, the patient who has had a robotic prostatectomy needs regular follow-up similar to any radical prostatectomy patient. Since the entire gland has been removed, follow-up PSA levels should be undetectable. An initial postoperative PSA should be obtained at 6 weeks after surgery. The patient should then be seen by his urologist at 3-month intervals for the first year, 6-month intervals for the second year, and annually thereafter. Each of these visits should include a DRE and a serum PSA as well as evaluation and treatment of functional outcomes such as continent and potency. A PSA level above 0.2 ng/mL is considered elevated and warrants further evaluation and/or treatment by a urologist.

Additional robotic prostatectomy information is available at author’s website: www.roboticconology.com.

References