Surgical Treatment for Localised Prostate Cancer Disease

Dr. Kim-chung TO
MBBS, FRCSEd (Urol.), FCSHK, FHKAM(Surgery)
Associate Consultant, Division of Urology, Department of Surgery, Princess Margaret Hospital

Dr. Ming-Kwong YIU
MBBS, FRCS(Ed.), FSCHK, Dip Urol(Lond), FHKAM(Surgery)
Consultant Urologist, Division of Urology, Department of Surgery, Princess Margaret Hospital

Introduction
Prostate cancer is a common male malignant disease worldwide. Its incidence rate varies widely between countries and ethnic populations. The incidence rates in Asian countries are much lower compared to Western countries. Environmental exposure, diet and lifestyle, as well as quality of the health care system and penetration of prostate specific antigen (PSA) screening affect the reported incidence rates. In Hong Kong, prostate cancer ranked the third most common male cancer and the fifth major causes of male cancer death in 2008.  Over 1300 cases of prostate cancer were diagnosed in 2008.

Treatment Options and Considerations
The widespread use of PSA has resulted in a remarkable stage migration in the past decade. There is an increasing proportion of patients with prostate cancer being diagnosed at an early and potentially curable stage. Prostate cancers also exhibit a wide spectrum of aggressiveness. Therefore, the preferred method of treatment remains controversial.

Treatment options for localised prostate cancers include active surveillance, surgery and radiation therapy (external beam or Brachytherapy). However, the treatment outcomes in any method are difficult to compare among studies because the populations of patients are usually not strictly comparable and the outcome measurements are not necessarily comparable between different forms of therapy.

In general, three significant factors contribute to the selection of therapy: (1) the overall life expectancy of the patients as determined by age and co-morbidities; (2) the biological characteristics of the tumour and prognostic information predicted from the Gleason grade, PSA level and clinical stage (e.g. using Partin tables or MSKCC Prostate Cancer Nomograms); and (3) the preferences of patients with consideration of complications, relative efficacy and quality-of-life issues.

Surgical Therapy
Radical prostatectomy requires complete removal of the prostate and seminal vesicles. It is the only treatment for localised prostate cancer that has shown a cancer-specific survival benefit when compared with watchful waiting in a prospective randomised trial. It is indicated in patients with low and intermediate risk localised prostate cancer (cT1a-T2b, Gleason score ≤7, and PSA ≤20) and a life expectancy of >10 years, and also in selected patients with low volume high risk localised prostate cancer (cT3a or Gleason 8-10 or PSA >20). Pelvic lymph node dissection can also be performed at the same time in selected patients with a risk of lymph node metastases.

Currently there are 3 approaches for radical prostatectomy, namely:

- Radical Perineal Prostatectomy
- Radical Retropubic Prostatectomy
- Laparoscopic Prostatectomy, with or without Robot-assisted

Radical Perineal Prostatectomy
This procedure was first described by Young in 1905. It was the first method used to remove the prostate as part of cancer therapy. The advantages of this procedure include a small perineal incision with better cosmesis, less blood loss, less pain and quicker recovery. It also allows precise watertight urethral anastomosis under direct vision. However, this procedure has fallen out of favour due to the disadvantages of requiring specialised instruments and unable to perform pelvic lymph node dissection (PLND) and it is not suitable for large sized prostates. There is also a higher rate of rectal injury and occasional post-operative faecal incontinence.

Radical Retropubic Prostatectomy
In 1947, Millin first described radical retropubic prostatectomy (RRP). This procedure is preferred over perineal prostatectomy because urologists are more familiar with the retropubic anatomy and the retropubic approach also allows an extraperitoneal pelvic lymph node dissection to be performed as staging purpose. However, this operation is fraught with possible massive blood loss.

In 1982, Walsh defined the peril prostatic, vascular, and erectile neural anatomy and developed the technique of nerve-sparing radical prostatectomy. The description and characterisation of the Santorini plexus has much reduced the operative blood loss and transfusion rate. In addition, the introduction of nerve-sparing technique has dramatically decreased the 2 most significant associated morbidities i.e. incontinence and impotence.

Laparoscopic Prostatectomy, Non-robotic and Robot-assisted
Minimally invasive surgical approach to treat prostate cancer was first described by Schuessler in 1997.
performed the first successful laparoscopic radical prostatectomy (LRP). However, this technique did not gain widespread acceptance as the procedure was technically extremely difficult. The initial series of 9 cases reported the operative times ranged from 8 to 11 hours. They concluded that this laparoscopic approach offered no significant advantage over open surgery.

The laparoscopic approach regained attention when two French groups (Guillonneau and Vallancien and Abbou et al.) reported on their techniques and early results in 1999 and 2000 respectively. The modified technique resulted in a shortening of operative time to 4-5 hours and a mean blood loss of 400ml. However, even in the hands of the skilled, this was still a technically demanding procedure with a steep learning curve. With further advances in technology with improved optics and new laparoscopic instruments such as ultrasonic cutting and coagulating devices etc., LRP began to gain acceptance and was performed increasingly in several high volume centres worldwide.

The introduction of Robotic Surgical System (Da Vinci Surgical System) into the field of urology has made another great advancement on minimally invasive prostatectomy. The first reported robot-assisted laparoscopic prostatectomy (RALP) using the DaVinci system was described by Abbou et al in 2001. Menon et al from the Vattikuti Urology Institute are responsible for the development and popularisation of robotic radical prostatectomy. This technique has been gaining widespread acceptance in the United States and Europe and is increasing in penetration worldwide. In Hong Kong there are already a few Systems (total of 5) installed in both public and private Hospitals for service since 2005. This master-slave system composed of a remote surgeon console and a surgical robotic arm system.

The surgeon console consists of the followings:
- Display system: a 3-dimensional stereoscopic display for the console surgeon
- Master arms: the surgeon’s thumbs and index fingers can hold and move the master arms that precisely translate to real-time movements of the robotic arm instruments under the vision of the 3D laparoscope.

The surgical robot arms have a camera arm for camera manipulation and two or three working arms, where different types of manipulation instruments (Endowrist) can be attached and interchanged during the operation.

The robot assisted laparoscopic technique provides a superb 3-dimensional stereoscopic vision with depth perception to the surgeon. Secondly, the movements of the robotic instrument are highly flexible and precise with the presence of articulated tips, it permits 7 degree of freedom in movement and mimicking human wrist movements, which is controlled by the console surgeon. Thirdly, the robotic system provides increased precision by filtering hand tremors, providing magnifications, and providing scaling for the surgeon’s movements. These result in decreased fatigue and shortened the learning curve of performing this operation for surgeons.

In general, minimally invasive prostatectomy (laparoscopic or robot assisted) could offer the advantage of less blood loss, less postoperative pain, less analgesic requirements and quicker recovery.

Complications and Management

Intra-operative and Early Complications
Haemorrhage can occur during and after radical prostatectomy. The average estimated blood loss in open RRP varies from 200 to 1500ml, depending on the size of the prostate, pelvic anatomy, surgical technique and length of operation. LRP and RALP are associated with less blood loss due to the tamponade effect of pneumoperitoneum and resulted in a much lower transfusion rate of less than 3%.

Rectal injury is uncommon during LRP and RALP (0.7% to 2.4%). Anastomotic leakage is usually minor and can be managed conservatively by prolonged catheterisation. Deep vein thrombosis and pulmonary embolism occur in about 1.6% of patients. Elastic stockings, early mobilisation and prophylactic anticoagulation can reduce the rate of thromboembolic events.

Other early complications include wound problems, post-operative ileus, urinary tract infection and lymphocele formation.

Late Complications
The important long term problems after prostatectomy are erectile dysfunction and urinary incontinence. Accumulating surgical experience could reduce the frequency of these complications as observed in large series from high volume centres. However, comparison of published series is difficult because of differences in patient populations, definition of outcomes and methods of assessment.

Recovery of erectile function after radical prostatectomy depends on the patient’s age, pre-operative erectile function and the extent of nerve-sparing surgery. In patients with normal pre-operative potency, potency is retained in 68% of patients who have undergone bilateral nerve-sparing and in 13-47% of men who have undergone unilateral nerve-sparing operation. Good results with erectile function after both minimally invasive approaches have been reported. Guillonneau et al showed a potency rate of 66% at 12 months after bilateral nerve-sparing LRP, while Joseph et al achieved a potency rate of 68% at 6 months after bilateral nerve-
sparing RALP. Moreover, erectile rehabilitation programmes using intracavernosal injection therapy or PDE-5 inhibitors have been shown to enhance the recovery of erectile function.

Urinary continence after RRP is generallygood but varies with the experience and skills of the surgeon. Age is also an important independent factor affecting the post-op urinary incontinence rate for a higher chance of incontinence (usually manifested as stress incontinence) was noted for patients operated at an age older than 65. Many high-volume centres could achieve more than 90% continence rate. Although laparoscopic approach again enables better visualisation of the operative field for more precise dissection of the prostatic apex and periurethral striated sphincter, published studies did not show significant differences in the continence rates. Technical modifications in LRP or RALP such as rhabdosphincter reconstructions have only shown some improvement in early continence in some studies. Kegel or pelvic floor exercises should be implemented early after surgery to increase the strength of external sphincter muscles.

Anastomotic strictures are uncommon complications with the laparoscopic approach (0% to 3%). It should be managed with self dilatation or intermittent dilatations by urologists. Internal incision or transurethral resection of scar tissue may be necessary but having a higher risk of incontinence.

**Prognosis and Outcomes**

The principal objective of radical prostatectomy is to completely excise the cancer. Radical prostatectomy allows accurate prediction of prognosis according to pathologic cancer features. Adverse pathological prognostic factors include non-organ confined disease, perineural or lymphovascular invasion, extra-capsular tumour extension, positive surgical margins, seminal vesical invasion, and lymph node metastases. A rising serum PSA level is usually the earliest evidence of tumour recurrence after radical prostatectomy. Therefore, biochemical recurrence is frequently used as an intermediate endpoint for treatment outcome. The actuarial 10-year cancer progression-free survival probability was approximately 90% for patients with organ-confined disease, 70% for men with extra-capsular tumour extension without cancerous surgical margins, 60% for men with extra-capsular tumour extension and cancerous surgical margins, 30% for patients with seminal vesicle invasion, and 15% for patients with lymph node metastases. Reported oncological outcomes for LRP and RALP are comparable with those of open series, although long term oncological data are limited.

**Conclusion**

The literatures support improved operative and perioperative parameters with minimally invasive
techniques, including reduced blood loss, shorter hospital stay and shorter post-operative catheterisation time. In addition, both laparoscopic and robotic radical prostatectomies seem to have comparable outcomes for functional parameters, namely potency and continence, compared with open prostatectomy. Reported oncological outcomes for laparoscopic and robotic radical prostatectomies are also comparable with those of open series, although long term oncological data are currently limited. The significant question that remains unanswered pertains to the cost-effectiveness of RALP compared with open and LRP. Nevertheless, minimally invasive radical prostatectomy is a desirable treatment for clinically localised prostate cancers.

References

1. Hong Kong Cancer Registry 2008, Hospital Authority