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Review Article

Robotic assisted radical prostatectomy

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ABSTRACT

Background: Robotic assisted radical prostatectomy (RARP) has become the commonest minimally invasive surgical procedure for the treatment of localized prostate cancer. Despite limited data supporting the excellence of RARP over laparoscopic radical prostatectomy (LRP) or open radical prostatectomy (ORP), it has gained wide acceptance among the patients and surgeons.

Objectives: The aim of this review is to present the most recent data and analyze the current status of RARP.

Methods: Medline was searched from 2005 to March 2015, restricted to English language. The Medline search used a strategy including medical subject headings (MeSH) and free-text protocols.

Results: RARP is equivalent to ORP in cancer control and may be advantageous in the preservation of continence and potency.

Conclusions: Available data suggest that RARP is a valuable therapeutic option for localized prostate cancer.

1. Introduction

Robot system in surgical field was introduced to reduce the difficulty in performing complex laparoscopic surgeries. The first system, with a surgeon's console and remotely controlled telemanipulators, was developed in 1991 and was named the Stanford Research Institute (SRI) Green Telepresence Surgery System after Phil Green, PhD, a researcher at SRI.[1,2] In 1995, Fredrick Moll licensed the commercial rights to the SRI Green Telepresence Surgery System and used this acquisition to find Intuitive Surgical Systems. A renovated master–slave clinical system was later released in April 1997 in prototype form as the da Vinci surgical system, which received US Food and Drug Administration (FDA) approval in July 2000. The da Vinci robot includes a true three-dimensional imaging system that provides magnification up to ×12. This system also incorporates the patented Endowrist technology, which duplicates the dexterity of the surgeon's forearm and wrist at the operative site, thus providing 7 degrees of freedom.

The first robotic assisted radical prostatectomy (RARP) was performed in May 2000 by Binder and Kramer. Since then there

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is no looking backwards. It has revolutionized the minimally invasive approach to prostate cancer. Already many institutions have adopted it as a standard of care for localized prostate cancer.[3] Steep learning curve of laparoscopic radical prostatectomy (LRP) has contributed substantially in the evolvement of RARP. The first RARP in the United States was performed in November 2000 at the Vattikuti Institute of Urology (Detroit, MI) by Vallencien.[4] Vattikuti Institute prostatectomy (VIP) team described an original technique and performed >1000 robot-assisted radical prostatectomies until 2004.[5,6]

2. Methods

Medline was searched from 2005 to March 2015, restricted to English language. The Medline search used a strategy including medical subject headings (MeSH) and free-text protocols.

A literature review was made using the keywords robotic prostatectomy, Robot assisted radical prostatectomy, RARP, robot assisted laparoscopic radical prostatectomy, RALP, cancer prostate, indications and contraindications, technique, efficacy, complications, Clavien, and the MeSH terms prostatectomy, oncological outcome, continence, potency, technique, intraoperative complications, or postoperative complications.

Case reports, editorials, reviews, and letters to the editor were not included.

3. Indications and contraindications

The indications of RARP are no different from that of open radical prostatectomy (ORP). Clinical stage T2 or less with no evidence of metastasis are indications of curative surgery in prostate cancer. Severe cardiopulmonary disease and uncorrectable bleeding diatheses are absolute contraindications.

4. Technique

Initial approaches described by European surgeons were antegrade Montsouris technique,[7] retrograde Heilbronn technique,[8] and the Frankfurt technique, which is a combined antegrade and retrograde technique. In the antegrade approach, dissection of prostate is done from bladder neck to apex, and in retrograde approach, it is done from apex to bladder neck. The former is most popular and recommended for minimizing the bleeding and traction, and optimizing the nerve-sparing dissection. Menon et al. described an original approach of robotic radical prostatectomy which is popularized as VIP technique.[9] All these are transperitoneal techniques. Later on extraperitoneal technique of RARP was developed. Though transperitoneal approach has advantages in those patients requiring pelvic lymph node dissection (PLND), yet no comparative studies between transperitoneal and extraperitoneal RARP have been published. Subsequently, attention was diverted to nerve-sparing techniques. Kaul et al. described a nerve-sparing VIP technique in 2005 by preserving prostatic fascia. Kaul et al. called this dissected prostatic fascia the ''veil of Aphrodite''.[10]

RARP is performed using the three- or four-arm da Vinci Surgical System (Intuitive Surgical, Sunnyvale, CA, USA). Port placement and number of trocars for the assistant can vary according to surgeon preference, but it must provide sufficient distance between the camera and working ports to prevent internal or external collision of instruments.[11] In the commonly used transperitoneal anterior/antegrade approach, first an inverted U-shaped incision is made starting lateral to medial umbilical ligament of one side extending anteromedially dividing the urachus in the midline and then continuing to the other side. Dissection is carried out, and the bladder is dropped. Prostatovesical junction is identified by bimanual bladder neck pinch. Bladder neck is then dissected. The seminal vesicles and vas deferens are identified and dissected one by one. Posterior dissection is done in the plane between seminal vesicles and the surrounding fascia. Lateral to seminal vesicals are the neurovascular bundles (NVBs). These have to be preserved while doing nerve sparing approach. Prostatic pedicles are clipped and divided here. To avoid injury to cavernous nerves, the minimal use of cautery and traction in the area of the seminal vesicles is recommended.[12] Earlier interfascial dissection and intrafascial dissection were the terms used to describe the nerve sparing approach. Now these terms have become obsolete with change in understanding in prostatic anatomy. Now newer concepts of incremental nerve-sparing procedures (full, partial, and minimal) are being used.

Circum-apical dissection of urethra is then done carefully, as prostatic apex is the most frequent site of positive surgical margin (PSM). The puboprostatic ligaments are then exposed, and divided sharply to gain access to the dorsal vascular complex (DVC). DVC is ligated with either one or two interrupted sutures, and then divided using scissors, monopolar electrocautery, or stapler devices. After the exposure of the prostatic apex, urethra is transected completely distal to the apex of prostate. The urethra is divided carefully to avoid injury to the neurovascular bundles and the sphincter. Finally, lymph node dissection is done, and the specimen is bagged.

Wide bladder neck is reconfigured using a ''tennis racquet'' stitch. Posterior reconstruction is done taking a few bites into the posterior aspect of Denonvilliers' fascia and the retrotrigonal layer (Rocco stitch). This step is an optional step, but has been proposed to improve the recovery of urinary continence. Although no prospective randomized trials have proven this hypothesis, better results were reported when a periurethral suspension stitch[13] or an anterior reconstruction[14] was added to the Rocco stitch. Vesico-urethral anastomosis is done in running suture using 3/0 V-lock suture (Van Velthoven suture). Proper mucosal approximation, tension-free approximation with avoidance of NVBs, and a secure water-tight anastomosis have to be created. Finally, Foley catheter and drain are placed. The anastomosis is to be tested intraoperatively by filling the bladder via catheter with normal saline and checking for leaks.

Postoperatively, oral diet is started from day 1. Patients are usually discharged with catheter, which is removed after 7–10 days post-surgery. A cystogram may be done before catheter removal in patients with high risk of leakage, e.g., post-TURP, salvage RARP.