Robotic Nephroureterectomy

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KEYWORDS

• Upper tract urothelial carcinoma • Nephroureterectomy • Robotic • Minimally invasive
• Distal ureterectomy

KEY POINTS

- With improved technology, robotic nephroureterectomy with excision of the bladder cuff has become a preferred approach for many institutions.
- Both single-docking and 2-docking approaches are safe and feasible; however, single-docking seems to significantly shorten the operative time.
- Perioperative outcomes for the robotic approach are comparable with laparoscopic and superior to open approaches.
- Although limited to observational studies, oncologic outcomes seem similar between all modalities.

INTRODUCTION

Among all new cancer diagnoses in 2017, upper tract urothelial carcinoma (UTUC) is estimated to account for 3% and 5% of new diagnoses in women and men, respectively.[1] Although UTUC makes up a small percent of all cancer diagnoses, there is controversy over how best to operatively manage patients, in particular when the decision to perform a nephroureterectomy (NU) is made. NU via an open approach (ONU) with bladder cuff excision has been the gold standard treatment for which all new techniques are compared.[2]

The evolution from ONU began in 1991 when laparoscopic NU (LNU) was first described.[3] Since that time, several comparative studies have demonstrated oncologic equivalence and superior perioperative results, such as length of stay, blood loss, decreased complications, convalescence, and pain with LNU.[4,5] The trend toward robotic surgery began in 2001 when the first robotic-assisted nephrectomy was described.[6] Several years later, a robotic-assisted bilateral hemineph-roureterectomy was described[7]; since then the use of robotic surgery has only continued to increase.

The adoption of robotic surgery has likely been rapid and heavily marketed for various reasons. In addition to falling under the umbrella of minimally invasive surgery, compared with LNU there are extra degrees of freedom as well as technically easier isolation of the distal ureter and bladder closure with articulation of the robotic wrists.[8] When a lymph node dissection is performed, the robot can facilitate dissection around the great vessels as well as provide 3-dimensional magnified vision. There is also an improved learning curve for various surgeries. For example, the learning curve for open radical prostatectomy ranges from 250 to 1000 cases and laparoscopic radical prostatectomy ranges from 200 to 750 cases; however, the learning curve for robot-assisted laparoscopic prostatectomy has been reported to be a few as 40 cases.[9] Robot-assisted

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radical cystectomy has a learning curve between 16 and 30 cases.[9] There is variation in the literature on how to define proficiency and what variables constitute proficiency at each procedure[10]; however, the use of surgical simulation does seem to play a role in expediting the time to proficiency.[11]

Although high-quality evidence supporting robotic NU (RNU) over ONU or LNU are lacking, this has not prevented the rapid adoption of RNU as a treatment of UTUC. A recent study using the National Cancer Database from 2010 to 2013 found that the utilization of RNU increased from 14% to 30%, whereas ONU decreased from 42.3% to 28.6%.[12] RNU was also associated with lower positive surgical margin rates and no difference in overall survival after controlling for tumor characteristics. With widespread availability of the robotic platform, increased utilization at training centers for other genitourinary cancers, and an increased focus on minimizing surgical morbidity and hospital stay, these trends suggest urologists are able to respect oncologic principles while potentially improving patient care.

ONCOLOGIC PRINCIPLES

With the evolution in technology, there is often a natural tension between improving surgical morbidity while not violating basic oncologic principles. According to the latest iteration of the European Association of Urology's (EAU) guidelines, these principles include removing the kidney and ureter en bloc with the bladder cuff, avoiding entering the urinary tract, avoiding direct contact between instruments and tumor, avoiding morcellation of the tumor, and, because of the concern for tumor spillage, avoiding performing minimally invasive NU for invasive or large (T3/T4, N+/M+) tumors.[2] This final recommendation is largely based on 2 things: minimal long-term LNU and RNU outcomes and reports of trocar site metastasis from manipulation[13,14] or tumor seeding with pneumoperitoneum.[15] However, as longer-term data begin to mature, operating on advanced-stage UTUC via minimally invasive approaches may become a more acceptable approach.

TECHNIQUE

A variety of techniques have evolved since the advent of RNU. Early reports often used 2 different modalities whereby the nephrectomy and ureteral dissection were performed robotically and the bladder cuff was performed open or laparoscopically.[16] The development of a hybrid port technique[16] or combination of 5 to 6 ports[17] allowed for the surgeon to perform the entire procedure robotically. Some describe using a 2-dock technique whereby patients are repositioned and the robot is redocked to maximize the working space in 2 distinct parts of the body.[18] Although it has been reported that redraping and redocking the robot can add up to 50 minutes of additional operative time,[19] redocking the robot with a skilled robotics team can be done in less than 10 minutes.[20] Others have reported single-docking techniques to eliminate redocking and repositioning altogether.[21,22] Here, the authors describe their preferred method to performing RNU with excision of the bladder cuff using a single-dock approach.

Positioning

The patients are positioned with a 45° bump using 2 sandbags, one cephalad to the break in the bed and one caudal to the break. The contralateral arm is placed on an arm board extended perpendicular to the bed while the ipsilateral arm is folded over the chest on 2 folded blankets for support. An axillary role is used based on the patients' body habitus and in consultation with the anesthesiologists, and the bed is put in slight flexion. The chest and hips are secured with surgical towels, foam, and 2-in silk tape (**Fig. 1**). The bed is rotated in both directions to ensure the patients are secure on the table.

Port Placement

Pneumoperitoneum is established using a Veress needle. At the authors' institution, the Robotic Surgical System allows more versatility for single-docking

Fig. 1. Positioning for a left-sided RNU in modified flank position.

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