Lower extremity neuropathy after robot assisted laparoscopic radical prostatectomy and radical cystectomy

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Introduction: *To describe the incidence and outcomes of lower extremity neuropathies in a series of robot assisted laparoscopic radical prostatectomy (RALRP) and robot assisted laparoscopic radical cystectomy (RALRC) patients with 9 months follow up. Additionally, we compare this cohort to other published series of lithotomy based surgery and describe strategies for minimizing risk.*

Materials and methods: *We performed a retrospective analysis of 179 consecutive patients who underwent either RALRP or RALRC at a single institution during a 17 month period. We included all patients who experienced bothersome lower extremity pain, weakness, or numbness at any time during their postoperative course. We further defined postoperative neuropathy as de-novo symptoms presenting in the first week postoperatively. Chart review and telephone survey were used to further characterize these patients.*

Results: *Six out of 179 patients complained of lower extremity neuropathic symptoms by 9 months of follow up. Probable injuries to the common peroneal, lateral femoral cutaneous, and obturator nerves were found. Three patients met our criteria for postop neuropathy making the incidence 1.68%. All patients remained ambulatory throughout their course. At 9 months follow up, only one patient, a man with metastatic bladder cancer, had activity limiting neuropathic symptoms.*

Conclusions: *With routine use of common risk minimizing strategies, RALRP or RALRC may result in lower extremity neuropathy at rates similar to other lithotomy based procedures described in the literature.*

Key Words: robotics, cystectomy, prostatectomy, neuralgia, lower extremity

Introduction

Lower extremity neuropathy is a well-documented complication of lithotomy based procedures.[1-3] Currently available robotic surgical systems require lithotomy position for urologic procedures such as robot assisted laparoscopic radical prostatectomy (RALRP) and robot assisted laparoscopic radical cystectomy (RALRC). Despite dramatic increase in robotic pelvic surgery, we are unaware of any previous published reports of lower extremity neuropathy. In November 2007, we began performing robotic assisted surgery at Wake Forest. We have steadily increased our volume of robotic surgery, especially lithotomy based pelvic surgery such as RALRP and RALRC. Early on, several patients complained of transient lower extremity neuropathic symptoms after surgery. This prompted careful review of our series of 149 consecutive RALRP and 30 consecutive RALRC patients and a review of the literature.

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Materials and methods

After institutional review board approval, we retrospectively analyzed the records of robotic prostatectomy and cystectomy patients who had complained of lower extremity symptoms from November 2007 until March 2009. Six patients were identified.

An independent investigator, who had no previous contact with the patients, administered a voluntary phone survey to further refine patients' symptoms and time-course. For purposes of final analysis, we further defined lower extremity neuropathy in a fashion similar to Warner et al as de novo lower extremity weakness, pain, or numbness presenting in the first week postoperatively.[3]

In all cases, a low lithotomy steep Trendelenburg position was used as described elsewhere.[5,6] It is our practice to return to a supine position for port closure (RALRP) or ileal conduit formation (RALRC). For all cases we employed Yellow-Fin stirrups (Allen Medical, Acton MA, USA) to provide abduction sufficient to allow positioning of the robot between the legs. We always use additional foam padding over the head of the fibula and use at least 45° flexion at the knee. For RALRC, egg-crate type foam back pads are employed due to the increased length of procedure. No bean bags or lumbar supports are routinely used.

Using a combination of blunt and sharp dissection, all RALRP patients underwent limited bilateral pelvic lymph node dissection for purposes of tumor banking and research. Extended lymphadenectomy was employed for RALRC.[5,6] Control of vascular and lymphatic structures was performed with Hem-O-Lok locking clips (PillingWeck,Markham, Ontario, Canada). Electrocautery, which was expressly minimized when working in vicinity of obturator or other peripheral nerves, was via a PK bipolar device through specialized PK robotic grasping forceps (Gyrus ACMI, Southborough MA, USA).

Any patient who complained of neuropathic symptoms at any time in the postoperative period was promptly referred for further evaluation by Sports-Medicine or Orthopedics with further work up by means of EMG or neurology referral if clinically indicated.

Results

Six patients, all male, complained of lower extremity neuropathic symptoms during their postoperative course, Table 1. Average follow up was 9.63 months,

TABLE 1. **Lower extremity neuropathic symptoms after robot assisted laparoscopic radical cystectomy (RALRC) or prostatectomy (RALRP)**

Pt.	Surgery	Side	Pain	Numbness	Weakness	Probable nerve	Further treatment	Symptom resolution	Confounders
1	RALRC	Left	Med thigh		Hip adduction + extension	Obturator	Sports Medicine, Physical Therapy	Significantly improved at 9 mos	Prior ipsilateral sciatica + weakness
2	RALRP	Left	Lat thigh	Lat thigh		Lat Fem cutaneous	Refused	Persistent at 9 mos	None
3	RALRP	Left	Lat thigh		General extension		Orthopedics, Chiropractor, Pain clinic	Persistent at 9 mos	Delayed onset, Long history of muscloskeletal pains
4	RALRC	Right		Dorsum foot	Dorsiflexion	Common perineal	Sports Medicine Physical Therapy	Significantly improved at 9 mos	Delayed onset Now with metestatic disease
5	RALRP	Left			General extension		Refused	Resolved at 3 mos	None
6	RALRP	Right			General extension		Refused	Resolved postop day 1	None

and all patients had 9 month data. One patient, #5, declined to participate in our phone survey, but had documented resolution of symptoms by 3 months postoperatively. Two patients with neuropathy received RALRC with extracorporeal ileal conduit for muscle-invasive bladder cancer, whereas the remaining four received RALRP for prostate cancer. The overall rate of lower extremity neuropathic symptoms in our series is 3.35% (6/179), occurring in 2.68% (4/149) of prostatectomies and 6.67% (2/30) of cystectomies. If we refine our definition to exclude patients with prior similar neuropathy (unlikely de novo) or a delayed presentation (unlikely a direct result of surgery), the overall rate of lower extremity neuropathy is 1.68% (3/179), occurring in 2.01% (3/149) prostatectomies and 0% (0/30) cystectomies, Table 1.

Overall average procedure time from initial positioning to end of closure was 244 minutes; 329 minutes for the two cystectomies and 202 minutes for the prostatectomies.

Average patient age was 61 years and average body mass index (BMI) was 28.64. Four of the six were present or past smokers and had smoked an average of 41.25 pack-years. Only one patient was a current smoker, the others having quit at least 6 years prior. Four of the six had history of back pain while 33.33% (2/6) had previous back surgery and 33.33% (2/6) were diabetic.

In terms of lower extremity symptoms, 83.33% (5/6) complained of lower extremity weakness whereas 50% (3/6) had numbness and 33.33% (2/6) had pain. Most patients had onset of symptoms immediately postoperatively, while two patients noticed symptoms at 2 and 4 weeks after surgery.

In three patients, we obtained a distribution of symptoms allowing identification of probable nerve injured, Table 1. Patient #1 had pain and weakness strongly favoring an obturator nerve injury, while patient #2 likely had symptoms indicative of injury to the lateral femoral cutaneous nerve and patient #4 demonstrated common peroneal nerve symptoms. The other three patients either refused further work up or symptoms resolved so quickly that we do not have enough information to adequately determine nerve of injury.

At 9 months postop, 66.67% (4/6) had persistent symptoms while 33.33% (2/6) had completely resolved, Table 1. Only one patient, #4 had significant symptoms which interfered with activities. This patient had delayed appearance of foot drop and had positive pelvic lymph nodes at cystectomy. They are currently being treated with physical therapy and are ambulating with a brace as directed by a Sports Medicine physician. The patient has declined further detailed work up by a neurologist or formal EMG studies. Patient #3 still requires medications in the form of as-needed over-the-counter non-steroidal anti-inflammatories for complete relief and also has declined further work up. The remaining two patients, #1 and #2 have mild persistent symptoms that do not interfere with daily activities or exercise.

Discussion

Several robust studies have characterized lower extremity neuropathies in patients undergoing procedures in lithotomy position, though none have included patients undergoing robotic pelvic surgery.[1-3,6] After reviewing over 198,000 cases in lithotomy, Warner et al found the rate of motor deficit that persists beyond 3 months to be 1 per 3608. In a later study, Warner looked prospectively at lower extremity neuropathy in 991 patients defined as any parasthesia or dysathesia within 1 week of a lithotomy based surgery. Patients with prior lower extremity neuropathy were excluded, and the incidence was 1.5%.[3] In a large series of 185 urethroplasties performed in extended or high lithotomy for a mean of 287 minutes, Nema et al found rates of lower extremity neuropathy 6.49%. In our population, we find the rate of de novo neuropathy occurring in the first week after robotic pelvic surgery to be 1.68% (3/179), which is similar to Warner's prospective series. If we include patient #1 (exacerbation of prior neuropathy), #3 (symptoms appeared at 2 weeks), and #4 (symptoms likely related to metastatic cancer), the overall rate of lower extremity neuropathy becomes 3.35% (6/179).

Common known risk factors for development of lower extremity neuropathy in lithotomy position include BMI less than 20, recent cigarette smoking, prior history of neuropathy, and duration of lithotomy position.[1,3,6] High BMI and type of stirrup has not been demonstrated to increase risk.[1] While 66.67% (4/6) of patients in this series had significant smoking history, only 16.67% (1/6) was a current smoker. Warner et al has estimated that the risk of neuropathy increases 100x for each hour in lithotomy and the risk of neuropathy is statistically higher for procedures > 4 hours.[6] At 263 minutes and 395 minutes, both cystectomies in this series took longer than 4 hours, but at least 1 hour of each was in supine position during formation of the ileal conduit. The average operative time for the four prostatectomies in this group is 202 minutes, with one taking over four hours at 290 minutes.

Tension, pressure, and ischemia to peripheral nerves may all be exacerbated by the unique positioning

requirements of pelvic robotic surgery. Steep Trendelenburg positioning greatly facilitates bowel retraction in robotic cystectomy and prostatectomy but is known to decrease transmural vascular pressures in the pelvis and abdomen.[1,7] This is no doubt true of the lower extremities and may cause relative compromise of lower extremity nerve perfusion. The effects of pneumoperitoneum may decrease lower extremity perfusion further and place additional mechanical pressure on nerves as they are pressed against bony structures by the expanding abdominal wall and displaced viscera.

Increased tension on the obturator nerve has been documented with hip abduction of only 30°.[8] With currently available robotic surgical systems, hip abduction is requisite for positioning of the robot in pelvic surgery.

While incidence of lower extremity neuropathy was comparable to other lithotomy procedures, we diligently employed perioperative risk-reduction strategies for all patients. During positioning, the area of the fibular head, corresponding to the site of the common peroneal nerve is padded to minimize pressure. A minimum necessary angle of hip abduction with concomitant 30° or greater knee flexion is used to decrease tension on the obturator nerve.[8] Low lithotomy, with minimal thigh extension, decreases tension on pelvic nerves and allows for less potential robot-patient interference. We re-evaluate position after robot docking, and the patient-side assistant continuously monitors robotic arm position to reduce likelihood of direct pressure to peripheral nerves. Electrocautery is minimized when dissecting in the vicinity of the obturator nerve. In addition, we return the patient to a supine position as soon as possible, which is done while maintaining a sterile field.

We further reviewed the periperative records of patients in which we identified the likely nerve in jeopardy, Table 1 to see if our standard preventative measures had been breached. In patient #1, probable obturator nerve injury, the left obturator nerve was identified and dissected away from the lymph node packet without the use of direct electrocautery, however the nerve was manipulated with cold instruments suggesting a possible stretch or crush injury. In patient #2, probable lateral femoral cutaneous nerve injury, we abided by our principle of low lithotomy positioning in effort to avoid over extension. In patient #4, probable common peroneal nerve injury, we used our standard method of additional foam padding over the lateral aspect of the knees on top of the supplied stirrup padding.

Conclusions

Despite the apparent increased risk of lower extremity neuropathies in robot assisted laparoscopic pelvic surgery, this series reports that the incidence appears comparable to other non-robotic lithotomy based procedures when routine risk-minimizing strategies are used. If recognized, neuropathic injuries should be characterized and referred appropriately to minimize their potential impact. □

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