

ROBOTIC-ASSISTED VESICO-VAGINAL FISTULA REPAIR: THE EXTRAVESICLE TECHNIQUE

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(Video Presentation to be made by Dr. Rogers)

Purpose: The optimal method of vesico-vaginal fistula repair remains undetermined. Previous descriptions of laparoscopic/robotic fistula repair involve utilizing a cystotomy. Patient selection, fistula recognition, positioning, port placement, intra-operative dissection techniques, flap formation, and repair are outlined in this video and manuscript for robotic repair of vesico-vaginal fistula utilizing an extravesicle approach.

Materials and Methods: The video showcases one patient with a vesico-vaginal fistula repaired with a robotic approach. A transperitoneal extravesicle technique was utilized. A four layer closure in addition to an omental flap interposition is demonstrated. Preoperative and postoperative information is also shared.

Results: The patient had a successful repair with no complications.

Conclusions: This video describes the successful repair of a vesico-vaginal fistula with a robotic-assisted extravesicle approach.

Source of Funding: None

ROBOTIC RESECTION OF A FEMALE URETHRAL LEIOMYOMA

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(DVD presentation to be made by Dr. Warner)

Purpose: Herein we demonstrate techniques to resect a female urethral mass robotically.

Materials and Methods: We present a case of a rare female urethral tumor, the workup and the minimally invasive management of the lesion. This is a 27 year old female who presents with pelvic pain, and was found to have a large mass anterior to the bladder on US. Further workup included an MRI which demonstrated a well circumscribed lesion likely originating from the anterior urethra. We elected to remove the lesion robotically.

Results: The patient was found to have a benign leiomyoma. She was kept in the hospital one night. Because of the involvement in the urethra she did keep her Foley catheter in position for one week; however post-operative cystogram demonstrated no extravasation.

Conclusion: Robotic resection is an effective treatment for female urethral masses.

Source of Funding: None

USE OF SINGLE INCISION LAPAROSCOPIC SURGERY FOR REMOVAL OF URACHAL REMNANTS

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(Presentation to be made by Dr. Choe)

Purpose: The presentation, diagnosis, and surgical management of pediatric urachal remnants continue to evolve. Within the span of 8 years the technique has advanced from open surgery to LESS (laparoscopic single site) surgery for treatment of urachal anomalies. We demonstrate a video presentation of our institutional series as well as a novel LESS approach for removal of urachal remnants.

Methods: A retrospective review of all patients undergoing an excision of a urachal remnant at one institution was performed from 2003-2011. Demographics, presenting symptoms, imaging, surgical method, surgeon specialty, urachal diagnosis and final pathology were analyzed. .

Results: Between 2003-2011, 40 patients who underwent removal of an urachal remnant were reviewed. The mean age was 5 years with a predominance of male patients (62%). The most likely presentation was omphalitis (35%) or abdominal pain (32%). The majority of patients (78%) had a bladder ultrasound but only a minority had a VCUG performed (32%). The most common types of remnants included umbilourachal sinus (24%), patent urachus (24%), infected urachal cyst (22%) and uninfected urachal cyst (22%). The majority of remnants contained transitional epithelium (49%). Only 10% of the first 19 surgeries were performed via a minimally invasive technique as compared to 27% of the last 18. Most recently, two have been done via a novel LESS approach as a partnership between pediatric general surgery and urology. The LESS method was one adopted from those performing appendectomies, utilizing a single incision with one trocar.

Conclusion: Although the presentation and diagnostic workup with urachal remnants can vary significantly amongst patients and practitioners, novel surgical approaches can be created as a collaborative process. Versatility with the LESS approach can be helpful for different procedures in both the general surgery and pediatric urology arena.

Source of Funding: None

ROBOTICALLY-ASSISTED LAPAROSCOPIC REMOVAL OF A GIANT FIBROEPITHELIAL POLYP OF THE URETER

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(Presentation to be made by Dr. Lewinshtein)

Introduction: Fibroepithelial polyps of the ureter are rare entities. Their diagnosis and management can be challenging. We submit a DVD highlighting a robotically-assisted laparoscopic resection of a giant fibroepithelial polyp.

Methods: This is a DVD presentation.

Results: This is a DVD presentation.

Conclusion: Fibroepithelial polyp of the ureter can be removed with robotically-assisted laparoscopy in a safe and effective manner. We suggest its use in future cases of this type.

Source of Funding: None

ROBOTIC ORCHIECTOMY: WHY IN THE WORLD.....?

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(Presentation to be made by Dr. Tyson)

Objective: To present the first reported case of robotic orchiectomy.

Case: We present the case of a 44 year old male with a history of left-sided cryptorchidism status post prior unsuccessful abdominal exploration. He was diagnosed with Gleason 3+3 adenocarcinoma of the prostate and subsequently underwent bilateral nerve sparing robot-assisted radical prostatectomy. Intraoperatively, inspection of the left inguinal ring revealed the intraabdominal testis. The vascular supply to the testis was ligated using Weck clips and the testis was removed and placed in a separate bag. Pathologic analysis revealed focal atrophy without spermatogenesis. Postoperatively, the patient has an undetectable PSA, excellent continence, and spontaneous erections rigid enough for penetration and sexual activity.

Conclusion: We present the feasibility of robotic intraabdominal orchiectomy. We will show video of the pertinent aspects of this operation during the presentation.

Source of Funding: None

ROBOTIC NEPHRECTOMY IN MANAGEMENT OF XANTHOGRANULOMATOUS PYELONEPHRITIS (XGP)

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(Presentation to be made by Dr. Kar)

Introduction: Xanthogranulomatous pyelonephritis (XGP) is a rare, serious, debilitating illness characterized by an infectious renal phlegmon. This disease process ultimately results in focal or diffuse renal destruction and is characterized pathologically by lipid-laden foamy macrophages. XGP shares many characteristics with true renal neoplasms in terms of its radiographic appearance and ability to involve adjacent structures or organs. Most cases of XGP are unilateral and are often associated with urinary tract obstruction, infection, nephrolithiasis, diabetes, and/or immunocompromise. The treatment of XGP is almost universally extirpative and can pose a formidable challenge to the surgeon.

We present a case of XGP in a 46 year old female patient with a h/o diabetes. She presented with symptoms of right sided abdominal pain and recurrent UTIs. Urine cultures showed E Coli. CT Scan showed a large hydronephrotic kidney with a staghorn stone. Nuclear renal scan showed 3 % of total renal function attributed to the right kidney.

She was taken to surgery for a Robot assisted Laproscopic Radical Nephrectomy .Surgery was performed with 5 Laproscopic ports. including use of the 3rd arm of the Robot. The kidney was very large and adherent to surrounding structures specially the IVC. Initial control of the hilum was achieved using the endovascular GIA stapler. Once Vascular control was achieved the entire kidney was mobilized. During the terminal stages of the procedure pus was seen extruding from the kidney. We moved rapidly to drain the pus and placed the kidney in a large Laprasac bag. The medial incisions were extended to 8cms to remove the bag with the contained kidney. The retroperitoneum was thoroughly irrigated and a Davol drain was placed through the lower port. The EBL was 200ml none of which was replaced intra-operatively.

Conclusions: Xanthogranulomatous pyelonephritis (XGP) is a surgically managed disease requiring either nephrectomy or, in rare circumstances, partial nephrectomy. Extirpation is necessary because the disease occurs or results in an infected, nonfunctioning kidney. We hereby demonstrate that the procedure can be done laproscopically with robotic assistance by experienced surgeons

RENAL SUSPENSION DURING ROBOTIC-ASSISTED PARTIAL NEPHRECTOMY

Jennifer Linehan*, MD., Robert Torrey, MD., David Josephson, MD., Tim Wilson, MD., and Clayton Lau, MD.:Duarte, CA.
(DVD Presentation to be made by Dr. Linehan)

Purpose: Demonstrate an effective technique for internal renal retraction to better expose the renal lesion, renal hilum, and allow for two handed dissection of the renal lesion during robotic-assisted partial nephrectomy.

Materials and Methods: 59-year-old patient with vague abdominal pain found to have 4cm solid enhancing left renal mass without lymphadenopathy or renal vein involvement by CT scan. Her serum labs were normal and urinalysis showed no hematuria. The patient was placed in lateral position at 90 degrees and the surgery was done by transperitoneal approach. The kidney and hilum were exposed robotically with a Da Vinci S HD system. With the inferior approach to the hilum, the gonadal vein was traced cranially to the renal vein and both the renal vein and artery were dissected free from surrounding tissue. During this time intraoperative U/S was performed to identify the tumor and surrounding normal parenchyma. The perirenal fat was dissected off the kidney leaving only the fat overlying the renal mass. To allow for faster tumor excision and better visualization of vascular pedicle, we performed a renal suspension using 2-0 vicryl suture with a knot and Hem-o-Lok clip at the end. The suture was placed thru the fat atop of the tumor and then thru the anterior abdominal wall in figure of eight fashion. With the sliding clip technique the tumor and lower pole of kidney was suspended anteriorly allowing for easier access for circumferential excision of the lesion. This allowed visualization of the artery without requiring robotic or bedside assistant to elevate the kidney. We clamped the artery with 2 bulldogs and 1 bulldog on the vein. The tumor was excised sharply with at least 1.5-2 cm normal margin. The tumor once free, hung safely suspended from the abdominal wall until it was placed within endocatch bag. A running 3-0 V-Loc stitch was placed through the tumor bed and secured with a Hem-o-Lok clip closing off the collecting system and open vessels. The outside renorrhaphy was done with four 0 CT-1 Vicryl in interrupted fashion and cinched down with Hem-o-Lok clips via a sliding clip technique. After 15 minutes of warm ischemia time, the bulldog from the renal vein was removed and the vein promptly refilled. The bulldog from the artery was removed. The remaining renal tissue was reperfused. We then observed the resection site and kidney to make sure there was no further bleeding. The tumor was cut free from the abdominal wall and placed in to an Endo Catch bag. The specimen was removed by enlarging the 12 mm assistant port.

Results: Warm ischemia time was fifteen minutes, the patient had no change in serum creatinine post operatively, and did not receive any blood products. The patient was discharged on post-operative day 2 with no complications or re-admissions to the hospital. The mass was found to be a renal cell carcinoma, clear cell type, Fuhrman Grade II, approximately 3.7 x 3.6cm. The margins were negative, and CT Scan at six months showed no local recurrence.

Conclusions: The sliding clip technique can be used to provide internal retraction during partial nephrectomy to assist in the exposure of the lesion during resection and allow one to two robotic or assistant instruments to be free to aid in the retraction and/or suction of the bleeding renal bed during excision.

ROBOTIC-ASSISTED LAPAROSCOPIC PARTIAL NEPHRECTOMY WITH NEAR INFRARED FLUORESCENCE IMAGING

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(Presentation to be made by David Josephson)

Purpose: Near infrared fluorescence imaging used with the daVinci® Si surgical system may improve the surgeon's ability to perform a partial nephrectomy. The objective of this DVD is to show the benefits of using this new technology at the time of robotic-assisted laparoscopic partial nephrectomy in one specific case.

Methods: One patient underwent robotic-assisted laparoscopic partial nephrectomy with use of a new camera that has infrared capabilities capable of detecting the fluorescence of intravascularly dosed Indocyanine Green (ICG) dye. The patient is a 70 year old male with no significant past medical history. On work-up for abdominal pain, he had an incidental, approximately 2cm partially exophytic right anterior, lower pole renal mass depicted on preoperative contrast-enhanced CT scan of the abdomen and pelvis. His preoperative creatinine was 0.9mg/dL with a GFR>60. All options were reviewed with the patient regarding observation, ablation, partial nephrectomy, and radical nephrectomy. The patient opted for surgical management with partial nephrectomy. Near-infrared fluorescence imaging was used for renal vascular identification, renal perfusion, differentiation of normal versus abnormal parenchyma, and evaluation of margin status. Specifically near-infrared fluorescence imaging was used to identify renal arterial branches for selective arterial clamping.

Results: Length of operation was 153 minutes with an EBL of 100cc and a selective ischemia time of 13 minutes. The remainder of the kidney was perfused throughout the entire procedure. The total dose of ICG given was 6.25mg in fractionated amounts at key points in the procedure. The specimen was bivalved on the back table and viewed under near infrared imaging. The tumor appeared dark in contrast to the rim of normal enhancing parenchyma surrounding it. The patient was discharged on post-operative day two with a post-operative, unchanged, creatinine of 0.9mg/dL. He had no adverse events following the surgery. Final pathology showed a 2.3cm, grade 2/4 Clear Cell Renal Cell Carcinoma with negative margins.

Conclusions: Near infrared fluorescence imaging can be safely used at the time of robotic-assisted laparoscopic partial nephrectomy. This technology may improve the surgeon's ability to perform selective vascular clamping, evaluate renal perfusion and re-perfusion, evaluate normal and abnormal renal parenchyma, and potentially assist in evaluation of renal margin status.

NAVIGATING THE DIFFICULT ROBOTIC PYELOPLASTY

Alexandra E. Rogers, M.D., David D. Thiel, M.D.: Jacksonville, Florida.
(Video Presentation to be made by Dr. Rogers)

Purpose: Robotic pyeloplasty is the gold standard for repair of ureteropelvic junction obstruction (UPJO). Technically challenging situations are not always well described secondary to the relative infancy of this surgical approach. Robotic assisted pyeloplasty has been widely adopted by urologists with and without prior robotic laparoscopic pyeloplasty experience. However, difficult situations encountered during robotic assisted pyeloplasty can significantly add to the difficulty of the operation. The manuscript and accompanying video provides tips for patient positioning, port placement, robot docking, and intra-operative dissection and repair in patients with the difficult situations.

Materials and Methods: Six patients with unique surgical anatomy are described and presented in a video format.

Results: Successful robotic pyeloplasty repair is described and showcased for six technically challenging patients. The five scenarios include crossing vessels, large redundant colon needing a trans-mesenteric pyeloplasty, generous sized calculi, previous UPJO surgery, enlarged floppy liver and an obese patient. All patients had a successful outcome.

Conclusions: Even in patients with technically challenging anatomy, robotic pyeloplasty may be successfully repaired even with these surgical hurdles. Techniques presented in this video and manuscript may aid in successful completion of robotic assisted pyeloplasty in the face of the difficult situations noted above.

Source of Funding: None

LAPAROSCOPIC DIAGNOSTIC RETROPERITONEAL LYMPH NODE BIOPSY

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(Presentation to be made by Dr. Zhumkhawala)

Purpose: In patients with testicular malignancy, radiologic imaging is the standard method to stage the level of possible metastasis. However, not infrequently the clinician encounters imaging that shows equivocal results that may not definitively stage the disease accurately. We hereby present a case of laparoscopic retroperitoneal lymph node biopsy. This procedure assisted in staging of the cancer, and more accurately guided pertinent therapy for the patient.

Materials and Methods: The patient is a 23 year old, otherwise healthy male who was found to have a right testicular mass. He underwent a right orchiectomy on 3/16/2011 with pathology showing pure seminoma with lymphovascular invasion (pT2). A CT abdomen and pelvis on 3/28/2011 showed two sub-centimeter inter-aortocaval retroperitoneal lymph nodes, 7mm and 8mm. A combined PET-CT scan on 4/7/11 showed no uptake in the retroperitoneal lymph nodes. Due to the fact that the lymph nodes were sub-centimeter in size and thus not clearly pathologic, there was some ambiguity as to whether the patient was stage I or stage IIa. The difference between the stages would yield different options for treatment and so a lymph node biopsy was deemed appropriate to more accurately stage the patient. On 4/26/2011, the patient was taken to the operating room for the above procedure. After general endotracheal anesthesia was induced, the patient was placed in the right lateral decubitus position. A 12 mm laparoscopic port was placed in the midline approximately 2 cm caudal of the umbilicus. A 5 mm port was placed in the midline in the sub-costal position to serve as a liver retractor. Two additional mm ports were placed in the midline equally spaced between the liver retractor port and the umbilicus. A final 5 mm port was placed along the mid-axillary line mid-way between the costal margin and the anterior superior iliac spine to assist with retraction of the right kidney. The white line of Toldt was incised and a plane dissected anterior to Gerota's Fascia. The ascending colon was dissected medially. The cephalad extent of the dissection was the renal vessels. The fascia overlying the great vessels was incised. A classic split-and-roll technique was used to expose the inter-aortocaval region at the level of the lower pole of the right kidney. The two enlarged nodes were encountered and carefully dissected off the vessels and the pre-vertebral ligament. All lymphatic channels were sealed with 5 mm Weck clips. Crossing sympathetic nerves were identified and preserved. The patient was discharged home on post-operative day number 1 with no apparent complications.

Results: The final pathology of the lymph node biopsy revealed two lymph nodes, 1.5 cm x 1 cm x 0.8 cm and 1.6 cm x 1 cm x 0.7 cm in size, consistent with pure seminoma without extra-capsular extension. As a result of the surgery, the patient who had initially contemplated observation given his initial diagnosis of Stage I seminoma, eventually elected to undergo external beam radiation therapy for his stage IIa disease.

Conclusions: Laparoscopic retroperitoneal lymph node biopsies can be safely performed in a minimally invasive fashion to limit the morbidity, increase the staging accuracy, and ensure that the appropriate treatment plan is recommended.

PRESERVATION OF PUBOVESICAL FASCIA DURING ROBOTIC RADICAL PROSTATECTOMY

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(Presentation to be made by Dr. Huang)

Objectives: One potential complication of radical prostatectomy is urinary incontinence. The acceptance of robotic surgery for prostate cancer has been accompanied by an evolution of robotic techniques. In 2010, 70% of all prostatectomies performed in the United States were done with robotic assistance. Recently, the importance of anatomic structures supporting the urethra and bladder neck in maintaining continence has been appreciated. The purpose of this video is to demonstrate a novel technique designed to improve urinary continence. This technique maintains the anterior support of the bladder neck by preserving the puboprostatic ligaments, which coalesce with the arcus tendineus levator ani, and pubovesical fascia and ligaments of the bladder.

Methods: A four arm robotic technique is employed with two assistant ports. The bladder is dropped down in the standard manner to expose the endopelvic fascia. In the pubovesical ligament sparing approach, pinpoint electrocautery is used to open the endopelvic fascia medial to the pubovesical ligaments. The dissection is carried out lateral to the prostate while preserving the puboprostatic and pubovesical ligaments as well as their attachments to the arcus tendineus levator ani. This is in contrast to the traditional approach, where the endopelvic fascia is opened at the lateral reflections and no specific effort is taken to preserve the pubovesical ligament or fascia. The automatic stapling device is used to transect the dorsal vein and secure the urethra anteriorly, against the pubic symphysis.

Results: The technique was employed in this 52 year old male with a Gleasons 3+3=6 prostate cancer found in bilateral cores on biopsy for a screening PSA of 12 ng/dL. The prostate was removed with negative margins and his PSA is undetectable. He returned to complete continence (pad and drip free) at 3 weeks after surgery.

Conclusions: Pubovesical ligament sparing radical prostatectomy aims to preserve anatomic anterior support for the urethra. Prospective randomized studies will be required to evaluate the effect of this technique. It has the potential to contribute to improvement of post-prostatectomy continence.

Source of Funding: None

V-LOC® ANASTOMOSIS OF NEOBLADDER DURING ROBOTIC-ASSISTED RADICAL CYSTOPROSTATECTOMY

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(DVD Presentation to be made by Dr. Linehan)

Purpose: Demonstrate two novel and effective techniques for completing the urethral anastomosis of orthotopic neobladder during robotic-assisted radical cystoprostatectomy using V-Loc® suture.

Materials and Methods: 72-year-old gentleman with a history of hematuria found to have non-muscle invasive high-grade transitional cell carcinoma (TCC). He had transurethral resection of his bladder tumors and was managed with intravesical therapy. He returned for subsequent evaluation with high volume, high grade TCC invading into the lamina propria. After discussing treatment options, patient underwent robotic-assisted laparoscopic radical cystoprostatectomy with bilateral extended pelvic lymph node dissection and creation of a Studer orthotopic ileal neobladder. Radical cystoprostatectomy and lymph node dissection were performed robotically in the first part of the procedure. Once this was completed, the Studer neobladder was created extracorporeal with sixty cm of ileum. The ureters were attached to the afferent limb of the neobladder using a direct end-to-side spatulated anastomosis. 8-French feeding tubes were placed as ureteral stents. The robotic ports were replaced and the abdomen was re-insufflated. At the most dependent portion of the closed neobladder, an opening was created using the robotic scissors. The posterior urethra was approximated to this opening using one previously placed urethral stitch and two other 2-0 Vicryl sutures in an interrupted fashion. Two V-Loc® sutures were placed on the right and left side of the posterior urethra. The sutures were run anterior and tied at the 12 o'clock position. A catheter was placed just prior to complete closure without complication. The anastomosis was water tight as it was tested with 120mL of normal saline with no extravasation.

A second technique is demonstrated during a similar case for use during instances of substantial distance between the urethral stump and the dependent portion of the neobladder. In this procedure, two V-Loc® sutures are joined at the tail end to form a one double armed suture. The locking barbs of the V-Loc® can aid in progressive delivery of the pouch distal toward the urethral stump. A gentle successive tensioning of each arm of the suture achieves mucosal apposition, establishing the urethral plate posteriorly. The anastomosis can then be continued in the standard fashion.

Results: Patient was discharged home without complications. His pathology revealed urothelial carcinoma in situ (pTis) with 0 of 42 lymph nodes positive. At his 3 months follow-up visit, he is wearing one safety pad per day and is continent. His creatinine is 0.71 and recent ultrasound revealed no hydronephrosis.

Conclusions: Urethral anastomosis of orthotopic neobladder is difficult to construct during robotic-assisted radical cystectomy given the position of the patient in Trendelenburg and length of the mesentery which can restrict the neobladder descent into the pelvis. The V-loc® sutures assist in formation of the urethral anastomosis with minimal tension for a tight seal between mucosal tissues providing optimal healing and continuity of the urinary channel.

Source of Funding: Covidien

ROBOT ASSISTED SIMPLE CYSTECTOMY, SAUCERIZATION AND DEBRIDEMENT OF PUBIC SYMPHYSIS, AND INTRA-CORPOREAL ILEAL CONDUIT URINARY DIVERSION FOR VESICO-SYMPHYSEAL SINUS

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(Presentation to be made by Dr. Cheney)

Introduction: Radiation therapy is a common treatment for prostate cancer. This therapy, however, is often accompanied by significant morbidity. Common side effects range from urinary incontinence, urinary retention, bladder and rectal irritation, and hemorrhagic cystitis. Rare side effects include secondary malignancy and fistula formation.

Methods: We present a patient with a large sinus between the bladder and pubic symphysis and resultant osteomyelitis. This video displays our management of this patient using a completely intra-corporeal approach, including robotic ileal conduit urinary diversion.

Results: Our patient did well in the post-operative period, regaining bowel function on post-op day #1 and was discharged on post-op day #5.

Conclusion: Intra-corporeal management of a vesico-symphyseal sinus with robotic-assisted cystectomy, pubic bone debridement, and ileal conduit urinary diversion is a manageable and viable treatment option. Typically, management of symphysis pubis osteomyelitis requires open debridement. Exposure of the inferior portion of the symphysis usually is achieved by disrupting the symphysis anteriorly. Robot assistance provided direct access to the inferior pubic symphysis leaving the anterior portion of the arch intact. Resection of the entire symphysis can result in posterior stress fractures of the pelvis, particularly in patients who had radiotherapy as part of their treatment. Advantages of this approach include rapid post-operative recovery, absence of a large abdominal incision, and better visualization of pelvic structures with the robot. Potential drawbacks include the need for advanced robotic skills, and longer operative times. It is anticipated that this method of debridement will result in both early and late reduction in patient morbidity. As more physicians gain the skills for intra-corporeal urinary diversion, this will hopefully become a more widespread technique and help patients achieve a more rapid recovery.

Source of Funding: None

NOVEL EX-VIVO ANIMAL TISSUE TRAINING MODELS FOR ROBOTIC SURGERY

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(Presentation to be made by Dr. Hung)

Purpose: To evaluate the feasibility of three ex-vivo animal tissue models for robotic surgery training and the reproducibility of an accompanying assessment tool.

Materials & Methods: Robotic surgery trainees were recruited in a prospective, institutional review board-approved study. Participants performed three ex-vivo animal tissue exercises utilizing the da Vinci Si Surgical System. '*Bowel Resection*' included a 60-cm cut segment of porcine large intestine with one end visible at the start of the exercise and the other anchored to the operative field. Instructions included 'running' the bowel and cutting along a circumferentially-inked line on the bowel. '*Cystotomy and Repair*' entailed performing a cystotomy along a 2.5-cm marked line on the anterior surface of a porcine bladder and repairing it with a two-layer closure aimed for water-tightness. '*Partial Nephrectomy*' utilized a porcine kidney with a 1.5" (~3.8 cm) Styrofoam ball embedded on it. A melon scooper with a 1-inch (2.54 cm) diameter was utilized to create a crater in the kidney. Super glue was used to fix the Styrofoam ball to the renal defect. Instructions were to excise the tumor while maintaining a clear tumor margin.

Three expert robotic surgeons, each with experience of over 300 robotic console cases, scored the participants while blinded to the identity of the participant. Subjective scoring was according to the validated Global Operative Assessment of Laparoscopic Skills (depth perception, bimanual dexterity, efficiency, tissue handling, autonomy to complete task) and two novel metrics (precision, instrument & camera awareness) (maximum 5 points per metric). Objective scoring for each exercise included time to task completion. All repaired bladders were tested for water-tightness with instillation of water at 50-ml increments up to 200 ml. Bladders that did not leak after 200 ml were then filled to 40 centimeters of water pressure. Partial nephrectomy specimens were evaluated for surgical margin status.

Results: Twenty-four robotic trainees completed the three exercises. Composite median scores were 24 points (range 19-31) for '*Bowel resection*,' 23 points (range 16-33) for '*Cystotomy and Repair*,' and 23 points (range 14-30) for '*Partial Nephrectomy*' (scoring between exercises $p=0.2$) (max 35 points). Spearman's correlation analysis found scoring between experts highly consistent ($r=0.7-0.8$, $p<0.001$). Novel metrics precision and instrument & camera awareness also highly correlated with the validated GOALS metrics ($r=0.9$, 1.0 , respectively; $p<0.0001$). Median time to complete all exercises was 38 minutes (range 31-62). 7/24 (29%) cystotomy repairs did not leak after being instilled with 200ml water, of which 6/7 (86%) did not leak after being filled to >40 cm H_2O . The negative margin rate for the partial nephrectomy exercise was 9/24 (37%).

Conclusions: The three novel ex-vivo animal tissue exercises designed for robotic surgery training are feasible and are consistently scored based upon a validated assessment tool along with two novel metrics.

Source of funding: Intuitive Surgical