# Perioperative and Short-Term Outcomes of Robotic vs Open Bladder Neck Procedures for Neurogenic Incontinence

Gwen M. Grimsby, Micah A. Jacobs, Vani Menon, Bruce J. Schlomer and Patricio C. Gargollo*

*From Children's Health and University of Texas Southwestern Medical Center, Dallas and Texas Children's Hospital, Houston (PCG), Texas*

**Abbreviations and Acronyms**

BNR = bladder neck reconstruction

LOS = length of stay

ORT = operative time

VP = ventriculoperitoneal

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* Correspondence: Texas Children's Hospital/Baylor College of Medicine, 6701 Fannin St., CCC Suite 620, Houston, Texas 77030 (telephone: 832-822-3160; FAX: 832-825-3159; e-mail: pcgargol@texaschildrens.org).

**Purpose:** Complex urological reconstruction may be facilitated by the improved magnification and dexterity provided by a robotic approach. Minimally invasive surgery also has the potential advantages of decreased length of stay and improved convalescence. We reviewed perioperative and short-term outcomes between robot-assisted and open bladder neck sling/repair with catheterizable channel in patients with neurogenic bladder.

**Materials and Methods:** We performed an institutional review board approved retrospective chart review of all patients who underwent open or robotic bladder neck reconstruction without augmentation cystoplasty for refractory urinary incontinence between 2010 and 2014. Age at surgery, operative time, length of stay, complications within 30 days of surgery and future continence procedures (injection of bladder neck/catheterizable channel, additional bladder neck surgery, botulinum toxin A injection) were compared between the groups.

**Results:** A total of 45 patients underwent bladder neck reconstruction (open in 26, robotic in 19) with a mean follow up of 2.8 years. There was no difference in preoperative urodynamics, age at surgery or length of stay (median 4 days in each group, $p > 0.9$). Operative time was significantly longer in the robotic group (8.2 vs 4.5 hours, $p < 0.001$). Three patients (16%) undergoing robotic and 3 (12%) undergoing open surgery had a complication within 30 days ($p > 0.9$). Of patients undergoing open repair 14 (56%) underwent 23 subsequent surgeries for incontinence. By comparison, 8 patients undergoing robotic repair (42%) underwent 12 additional procedures ($p = 0.5$).

**Conclusions:** Although a robotic approach may take longer to perform, it does not result in increased complications or length of stay, or worsened continence outcomes.

**Key Words:** robotics; spinal dysraphism; urinary bladder, neurogenic; urinary incontinence

As found with the success of robotic prostatectomy in the adult urological population, complex urological reconstruction in children may be facilitated by the improved magnification and dexterity provided by a robotic approach.[1] Thus, minimally invasive approaches have become extremely popular for renal surgery in children due to the benefits of decreased length of stay, improved convalescence and superior cosmesis.[2,3] Because of these



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advantages, providers have slowly applied robotic technology to more advanced urological procedures such as bladder neck reconstruction and bladder augmentation.[1,4]

Although robot-assisted bladder neck reconstruction has been described in small case series,[4,5] no comparison to an open cohort of patients has been performed. Previous reports have emphasized the feasibility of robotic BNR but data are lacking on acute complications, incidence of reoperation and long-term continence outcomes.[6] Before any new surgical approach to a well established open technique is widely adopted it is prudent to ensure that the complication and reoperation profiles are similar. We hypothesized that there would be no difference in the number of acute complications or future continence surgeries needed for patients who had undergone robotic vs open BNR for treatment of neurogenic incontinence. We reviewed perioperative and short-term outcomes between robot-assisted and open bladder neck sling/repair with catheterizable channel in children with neurogenic bladder.

## MATERIALS AND METHODS

An institutional review board approved retrospective chart review was performed of all patients who underwent robot-assisted or open bladder neck reconstruction with bladder neck sling and catheterizable channel (appendicovesicostomy or Monti) without augmentation cystoplasty for urinary incontinence refractory to clean intermittent catheterization and maximal anticholingeric therapy. Operations were performed at a single institution by 3 surgeons between 2010 and 2014. Patients who had previously undergone urological surgery were not excluded, nor were there any age restrictions for use of a robotic approach. Open and robotic bladder neck sling and reconstruction were performed as described previously.[4,7,8]

Preoperative demographic and urodynamic data, operative time, LOS and acute complications (defined as within 30 days of surgery) were compared between patients who had undergone open and robotic BNR. Any patient who underwent a robotic procedure that was converted to open was analyzed as a member of the robotic group. Because of the often unreliable and subjective surgeon assessment of continence, we chose to report continence outcomes based on subsequent continence surgeries. Thus, redo BNR, bladder neck closure and bladder neck/catheterizable channel bulking agent injection were identified and compared between the groups. Bladder neck injection after previous bladder neck surgery was performed as described previously.[9] Indications for future surgeries were provider dependent but usually included redo BNR or bulking agent injection for incontinence and augmentation cystoplasty for incontinence or upper tract changes.

Histograms were performed to assess for normalcy of data. For normally distributed continuous data comparison of mean was completed with unpaired t-tests. For skewed or nonparametric data comparison of medians was performed with Wilcoxan rank sum test. Categorical data were compared with the Fisher exact test. An alpha of less than 0.05 was considered statistically significant. Data were analyzed using STATA®, version 12.

## RESULTS

A total of 26 patients underwent open and 19 underwent robotic BNR between 2010 and 2014. Mean followup was 2.8 years (range 0.3 to 4.9), mean ± SD age at surgery was 9.1 ± 0.52 years and 23 patients (51%) were male (table 1). Most patients (76%) had incontinence secondary to spina bifida and the majority had undergone no previous urological surgery. The most common prior procedures were vesicostomy (11%) and subureteral injection of bulking agent for treatment of vesicoureteral reflux (11%, table 1). No patient had previously undergone augmentation cystoplasty or bladder neck reconstruction.

Of the 19 robotic procedures 3 (16%) were converted to an open procedure. In all 3 cases the reason for open conversion was difficultly with the appendicovesicostomy channel. Difficulties included 1 case where the appendix was unable to be cannulized, 1 where the appendix could not be found and 1 in which the appendix did not reach the abdominal wall. In all 3 cases bladder neck reconstruction and bladder neck sling were performed robotically and the procedure was converted to an open approach only for creation of the Monti channel after it was determined that the appendix was unsuitable for appendicovesicostomy.

In comparing the open and robotic cohorts, there was no difference in age at surgery, gender,

**Table 1.** *Preoperative demographics*

| | | |
|---|---|---|
| No. male/total No. (%) | 23/45 | (51) |
| Mean yrs followup (range) | 2.8 | (0.3—4.9) |
| Mean yrs age at surgery (range) | 9.1 | (4.3—17.6) |
| No. ambulatory/total No. (%) | 20/45 | (44) |
| No. VP shunt/total No. (%) | 31/45 | (69) |
| No. diagnosis/total No. (%): | | |
| Spina bifida | 34/45 | (75.6) |
| Spinal cord injury | 1/45 | (2.2) |
| Transverse myelitis | 1/45 | (2.2) |
| Tethered cord | 2/45 | (4.4) |
| Caudal regression | 2/45 | (4.4) |
| Lipomeningocele | 3/45 | (6.7) |
| Posterior urethral valves | 1/45 | (2.2) |
| Prune belly syndrome | 1/45 | (2.2) |
| No. race/total No. (%) | | |
| White | 21/45 | (46.7) |
| Black | 5/45 | (11.1) |
| Hispanic | 18/45 | (40.0) |
| Asian | 1/45 | (2.2) |
| No. prior surgery/total No. (%) | | |
| Vesicostomy | 5/45 | (11.1) |
| Dextranomer/hyaluronic acid subureteral injection | 5/45 | (11.1) |
| Ureteral reimplantation | 2/45 | (4.4) |
| Catheterizable channel | 3/45 | (6.7) |
| Bladder neck injection | 2/45 | (4.4) |