# The Effect of Resident Involvement on Surgical Outcomes for Common Urologic Procedures: A Case Study of Uni- and Bilateral Hydrocele Repair

**Björn Löppenberg, Philip J. Cheng, Jacqueline M. Speed, Alexander P. Cole, Malte W. Vetterlein, Adam S. Kibel, Joachim Noldus, Quoc-Dien Trinh, and Christian P. Meyer**

**OBJECTIVE** Previous studies have investigated the effect of resident involvement (RI) on surgical complications in minimally invasive and complex surgical cases. This study evaluates the effect of surgical education on outcomes in a simple general urologic procedure, unilateral and bilateral hydrocele repair, in a large prospectively collected multi-institutional database.

**METHODS** Relying on the American College of Surgeons National Surgical Quality Improvement Program Participant User files (2005-2013), we extracted patients who underwent unilateral or bilateral hydrocele repair using Current Procedural Terminology codes 55040, 55041, and 55060. Cases with missing information on RI were excluded. Descriptive and logistic regression analyses were performed to assess the impact of RI on perioperative outcomes. A prolonged operative time (pOT) was defined as operative time >75th percentile.

**RESULTS** Overall, 1378 cases were available for final analyses. The overall complication, readmission, and reoperation rates were 2.3% (32/1378), 0.5% (7/1378), and 1.4% (19/1378), respectively. A pOT was more frequently observed in bilateral procedures (35.2% vs 21.3%, $P < .0001$) and with RI (33.8% vs 19.0%, $P < .0001$). Procedures with RI had a 2.2-fold higher odds of pOT (95% confidence interval 1.7-2.8, $P < .0001$). Overall complications (odds ratio 1.1, 95% confidence interval 0.5-2.3) were not associated with RI ($P = .789$). In sensitivity analyses, all postgraduate years of training were associated with a pOT ($P < .0001$).

**CONCLUSION** Although the involvement of a resident in hydrocele repairs leads to higher odds of pOT, it does not affect patient safety, as evidenced by similar complication rates. UROLOGY 94: 70–76, 2016.


In an era of cost containment, quality measures, increased liability risk,[1] and patient safety concerns, resident involvement (RI) in surgeries has come under increasing scrutiny.[2,3] Whereas much of the literature focuses on complex procedures[4] or minimally invasive procedures[5,6] that may have a steep learning curve for residents, there is little data on the effect of RI in simple open surgical cases. However, in the latter kind of cases, residents are more likely to do a significant portion of these cases and are more likely to have more autonomy during the case. In the urologic setting, a hydrocelectomy is one frequently encountered general case. A hydrocele is a free-fluid collection between the visceral and parietal layers of the tunica vaginalis, and is the most common cause for benign scrotal enlargement.[7] It affects 1% of adult men over the age of 40,[8] and occurs bilaterally in about 7%-10% of cases.[9] The most common underlying causes are an imbalance between production and absorption of serous fluid in the presence of a patent processus vaginalis; an excessive production of serous fluid in infectious testicular diseases; an interference of lymphatic drainage seen in some parasitic diseases; trauma; and testicular cancer.[10] Although most hydroceles are asymptomatic, patients may seek treatment if they become large enough to cause discomfort or for cosmetic reasons. Surgery represents the gold standard for definitive management of hydroceles,[11,12] and a hydrocele repair is a basic common procedure taught in resident training. Typical complications include hematoma, infection, and persistent swelling.

**Financial Disclosure:** *The authors declare that they have no relevant financial interests.*
**Funding Support:** *Björn Löppenberg is supported by the Heinrich Hertz-Stiftung of the Ministry for Innovation, Higher Education, and Research of North-Rhine Westphalia, Germany.*

*From the Center for Surgery and Public Health and Division of Urologic Surgery, Brigham and Women's Hospital, Harvard Medical School, Boston, MA; the Department of Urology, Marien Hospital Herne, Ruhr-University Bochum, Herne, Germany; and the Department of Urology, University Medical Center Hamburg-Eppendorf, Hamburg, Germany*

*Address correspondence to: Björn Löppenberg, M.D., Center for Surgery and Public Health and Division of Urologic Surgery, Brigham and Women's Hospital, Harvard Medical School, 45 Francis St, ASB II-3, Boston, MA 02115. E-mail: loeppenberg@googlemail.com*

*Submitted: February 19, 2016, accepted (with revisions): March 3, 2016*



http://dx.doi.org/10.1016/j.urology.2016.03.045
0090-4295

Given the high standard for cost containment and optimal outcomes in health care, specifically surgical outcomes, we sought to evaluate RI in a simpler procedure, unilateral and bilateral hydrocele repair, and to assess the impact of RI on complication rates and perioperative outcomes using a large national sample.

## METHODS

### Population Source

This study is based on the National Surgical Quality Improvement Program (NSQIP) database, which is a prospective initiative by the American College of Surgeons that collects risk-adjusted data to facilitate the measurement of outcome measures after surgery.[13,14] A dedicated surgical reviewer collects the NSQIP data. These validated data sets from patients' medical records allow quantification of 30-day risk-adjusted surgical and medical complications. In 2013, the NSQIP participant user file includes data from 2,972,860 cases from 435 participating sites.

### Study Population

An institutional review board waiver was obtained from the Brigham and Women's Hospital in accordance with institutional policy when dealing with de-identified administrative data. Cases with unilateral and bilateral hydrocele repair between January 1, 2006 and December 31, 2013 were identified using Current Procedural Terminology codes (55040, 55041, and 55060). Any cases with missing information on RI were excluded.

### Covariates

For all patients, age, race, smoking status, body mass index (BMI), American Society of Anesthesiologists physical status, and type of surgery (unilateral vs bilateral) were extracted. RI was stratified into two categories: attending alone vs RI.

### Outcomes

The primary end point was any intraoperative or postoperative complication. Complications were categorized as follows: intra- or postoperative blood transfusions, wound complications (superficial, deep, and organ space surgical site infection as well as wound dehiscence), cardiovascular (postoperative cardiac arrest, myocardial infarction, or cerebrovascular accident), pulmonary (pneumonia, need for prolonged postoperative ventilation or reintubation), thromboembolic (deep venous thrombosis and pulmonary embolism), sepsis and septic shock, renal (acute renal failure and progressive renal insufficiency), and urinary tract infection. These were subsequently summarized into a composite variable for multivariable analysis. Secondary outcomes consisted of prolonged length of stay (pLOS), defined as inpatient stay ≥2 days, and prolonged operative time (pOT), defined as the >75th percentile (>53 minutes). Finally, 30-day readmission data were reported for procedures beginning January 2012.

### Statistical Analyses

Descriptive statistics of categorical variables focused on frequencies and proportions. Means, medians, and interquartile ranges (IQRs) were reported for continuously coded variables, as appropriate. The chi-square test and Mann-Whitney *U* test were used to compare proportions and medians, as appropriate. Subsequently, multivariable logistic regression models tested the association between preoperative covariates and the aforementioned outcomes. Covariates consisted of age, BMI, laterality, and RI. Subanalyses with RI stratified according to postgraduate year (PGY) (junior [PGY 1-2], senior [PGY 3-4], or chief [PGY 5]) were also performed. All statistical tests were performed using SPSS (version 23, IBM, Armonk, NY) with a 2-sided significance level set at $P < .05$.

## RESULTS

### Descriptive Analyses

After excluding cases without information on RI, a final study population of 1378 cases remained for analysis (81.9% [1128/1378] unilateral and 18.1% [250/1378] bilateral). A comparison of the cases with missing information on RI to those with information on RI showed no differences concerning preoperative, intraoperative, and postoperative variables (data not shown). Descriptive characteristics and outcomes stratified according to unilateral vs bilateral hydroceles are shown in Table 1. Median patient age (IQR) was 58 (48, 68) years. A higher proportion of patients with bilateral hydroceles were older ($P = .047$). Median BMI was 28.2 (IQR 25.1-32.6), and 38.7% (533/1378) of patients were obese (defined as BMI >30). Bilateral hydrocele was more common in obese patients ($P = .001$).

Descriptive characteristics and outcomes stratified according to RI are shown in Table 2. Residents took part in 31.4% (433/1378) of the cases and RI did not differ between unilateral and bilateral procedures ($P = .924$). The PGY status of the residents were as follows: 29.8% (129/433) for PGY1-2, 47.8% (207/433) for PGY3-4, and 22.4% (97/433) for PGY5. Patient characteristics did not differ between resident and attending-only cases, except for race, with residents performing more procedures on non-White patients (18.7% vs 10.9%, $P < .001$).

### Outcomes

The overall complication rate was 2.3% (32/1378), with wound complications being the most common in 1.6% (23/1378) of cases. Overall readmission and reoperation rates were 0.5% (7/1378) and 1.4% (19/1378), respectively. There was no difference in complications with regard to unilateral vs bilateral approach and RI ($P > .05$, respectively) (Table 2).

Although pLOS occurred more often in bilateral procedures (2.8% vs 1.2%, $P = .049$), RI did not play a role ($P = .973$). A pOT was observed more often in bilateral procedures (35.2% vs 21.3%, $P < .0001$). Cases with RI were significantly prolonged in both unilateral and bilateral cases ($P < .0001$, respectively; Table 2).