Can Activities of Daily Living Predict Complications following Percutaneous Nephrolithotomy?

David A. Leavitt,* Piruz Motamedinia, Shamus Moran, Michael Siev, Philip T. Zhao, Nithin Theckumparampil, Mathew Fakhoury, Sammy Elsamra, David Hoenig, Arthur Smith and Zeph Okeke

From the Smith Institute for Urology, Hofstra North Shore-Long Island Jewish School of Medicine (DAL, PM, SM, MS, PTZ, NT, MF, SE, DH, AS, ZO), New Hyde Park, New York, Vattikuti Urology Institute, Henry Ford Health System (DAL), Detroit, Michigan, Department of Urology, Yale University (PM), New Haven, Connecticut, and Rutgers Cancer Institute (SE), New Brunswick, New Jersey

Purpose: Activities of daily living provide information about the functional status of an individual and can predict postoperative complications after general and oncological surgery. However, they have rarely been applied to urology. We evaluated whether deficits in activities of daily living could predict complications after percutaneous nephrolithotomy and how this compares with the Charlson comorbidity index and the ASA® (American Society of Anesthesiologists®) classification.

Materials and Methods: We retrospectively reviewed the records of all patients who underwent percutaneous nephrolithotomy between March 2013 and March 2014. Those with complete assessment of activities of daily living were included in analysis. Perioperative outcomes, complications and hospital length of stay were examined according to the degree of deficits in daily living activities.

Results: Overall 176 patients underwent a total of 192 percutaneous nephrolithotomies. Deficits in activities of daily living were seen in 16% of patients, including minor in 9% and major in 7%. Complications developed more frequently in those with vs without deficits in daily living activities (53% vs 31%, $p = 0.029$) and length of stay was longer (2.0 vs 4.5 days, $p = 0.005$). On multivariate logistic regression activities of daily living were an independent predictor of complications (OR 1.11, $p = 0.01$) but ASA classification and Charlson comorbidity index were not.

Conclusions: Activities of daily living are easily evaluated prior to surgery. They independently predict complications following percutaneous nephrolithotomy better than the Charlson comorbidity index or the ASA classification. Preoperative assessment of daily living activities can help risk stratify patients and may inform treatment decisions.

Key Words: kidney calculi; activities of daily living; nephrostomy, percutaneous; postoperative complications; risk

Abbreviations and Acronyms

ADL = activity of daily living

BMI = body mass index

CCI = Charlson comorbidity index

PCNL = percutaneous nephrolithotomy

Accepted for publication December 18, 2015.

No direct or indirect commercial incentive associated with publishing this article.

The corresponding author certifies that, when applicable, a statement(s) has been included in the manuscript documenting institutional review board, ethics committee or ethical review board study approval; principles of Helsinki Declaration were followed in lieu of formal ethics committee approval; institutional animal care and use committee approval; all human subjects provided written informed consent with guarantees of confidentiality; IRB approved protocol number; animal approved project number.

* Correspondence: Vattikuti Urology Institute, Henry Ford Hospital, 2799 West Grand Blvd., K9, Detroit, Michigan 48202 (telephone: 313-916-2066; FAX: 313-916-7577; e-mail: david.a.leavitt@gmail.com).

THERE is considerable interest across the surgical community in the ability to predict which patients are at highest risk for perioperative complications.[1–6] In urology this is particularly true for PCNL, after which complications are common at 20% to 50% of cases and occasionally life threatening.[4,7–9] Indeed, myriad studies have attempted to determine predictors of PCNL related complications.[10–12]

0022-5347/16/1956-1805/0
THE JOURNAL OF UROLOGY®

http://dx.doi.org/10.1016/j.juro.2015.12.076
Vol. 195, 1805-1809, June 2016
Printed in U.S.A.

CCI, which represents an aggregate of preexisting chronic diseases, and ASA score have been shown to predict postoperative complications in a variety of settings, although use in endourology and specifically for PCNL has been limited. However, these metrics are imperfect and incomplete since ASA score relies partly on assessor subjectivity. In addition, neither ASA score nor CCI objectively incorporates patient functional status, which is becoming recognized as one of the most potent predictors of complications.[2,6,13]

Assessment of ADLs, which can provide basic and objective information on individual functional status, has been in use for more than a half century.[14] Moreover, ADLs do not rely on subjectivity and are easy to evaluate. In use in the geriatric literature for aging, in recent years ADL assessment has been applied to surgical oncology. It has repeatedly proved to be a reliable predictor of complications, hospital stay and discharge destination.

However, to our knowledge ADLs have not been widely applied to urology or at all to PCNL. To this end we sought to determine whether deficits in ADLs could predict post-PCNL complications and how this would compare with CCI and ASA.

MATERIALS AND METHODS

In this institutional review board approved, retrospective study we reviewed all PCNL procedures performed between March 2013 and March 2014 at a single institution by 3 experienced endourologists (DH, AS and ZO). ADLs were assessed by an internist along with history and physical examination as part of preoperative testing in all patients scheduled for elective surgery at our institution. Assessment was done within 30 days of surgery. We included patients in whom a full ADL assessment was performed preoperatively. Patients without a complete ADL assessment and those younger than 18 years were excluded from analysis. Patient demographics, perioperative outcomes, ASA score, CCI and complications were collected from patient charts.

The ADL evaluation assessed patient ability to perform basic functional activities that are considered the essential elements of self-care and have been deemed necessary for independent survival.[14] Individual ADL tasks included ambulation, transferring, toileting, bathing, dressing, eating, communicating and swallowing. Communicating assessed patient difficulty with or complete inability to understand and/or speak while swallowing gauged difficulty with consuming liquids and foods. Each individual ADL was scored on a scale between 0—no deficit and complete independence, and 4—full deficit and complete dependence. In addition, a total ADL score was calculated by summing the score of each individual ADL with 0 representing complete independence in all ADLs and 32 representing complete dependence in all ADLs.

Composite deficits in ADLs were stratified into 3 groups, including 1) no deficit in any ADL category (no deficit), 2) at least a single score of 1 in any ADL category but no score greater than 1 in any category (minor deficit) and 3) at least a single score of 2 in any ADL category (major deficit).

CCI was calculated based on patient comorbid conditions present at the same time that ADLs were assessed.[15] ASA classification was determined on the day of surgery by the anesthesiologist overseeing the surgery.[16,17]

All PCNLs were performed with the patient prone. Percutaneous renal access was achieved by the urologist except in patients with a preexisting nephrostomy catheter. Access tracts were dilated to 30Fr with NephroMax™ balloon dilators or Amplatz renal dilators (Cook® Medical) according to surgeon preference. A CyberWand® ultrasonic lithotripter and a 24Fr rigid nephroscope were used. Postoperative renal drainage catheter type was determined according to surgeon judgment.

Operative time included cystoscopy, ureteral catheterization, prone repositioning, renal access, stone removal and drain placement. Stone size was calculated as the largest diameter in any dimension of the single largest stone. All complications within 30 days of surgery were included and graded according to the modified Clavien-Dindo classification as minor—Clavien I or II, or major—Clavien IIIa or greater.[18] For patients treated with staged procedures during the same hospitalization length of stay was calculated from the date of the last procedure performed. Patients with contaminated preoperative urine cultures were considered to have positive urine cultures because many of them received preoperative antibiotics as if the culture were positive.

All statistical analyses were performed using STATA®/IC, version 11.0 with $p < 0.05$ considered significant. Continuous variables were compared across the 3 ADL substratifications using ANOVA with the Bonferroni post hoc test. Categorical variables were compared using the Fisher exact test when appropriate. Univariate and multivariate logistic regression analyses were performed to determine predictors of a perioperative event and ORs.

RESULTS

We identified 176 patients who underwent a total of 192 PCNLs, including 16 staged procedures. The table shows patient characteristics. A majority of patients with major ADL deficits were women. Of the entire study cohort 7% showed major deficits, 9% had minor deficits and 84% showed no deficits. Mean BMI was 29.9 kg/m^2 in the entire study group. Mean stone size, and the proportion of partial and full staghorn stones did not significantly differ among the groups. Overall mean ASA score was 2.4 with a significantly lower average ASA score in patients with no ADL deficits compared to those with minor and major deficits (2.3 vs 2.8 and 3.1, respectively, $p < 0.001$). A similar result was seen for CCI, including for no ADL deficits, a minor deficit and a major deficit (0.71, 1.5 and 1.8, respectively, $p < 0.001$).

Complications developed in 61 of 176 patients (35%), including 31% with no ADL deficits, 47%