Bladder Augmentation Versus Urinary Diversion in Patients With Spina Bifida in the United States

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Purpose: Augmentation cystoplasty has replaced urinary diversion as the cornerstone of surgical management of refractory neurogenic bladder in patients with spina bifida. Other than single institution series little is known about practice patterns of bladder augmentation vs diversion. Therefore, we characterized the use of bladder augmentation and urinary diversion in patients with spina bifida in a nationally representative, all payer, all ages data set.

Materials and Methods: Discharge estimates were derived from the Nationwide Inpatient Sample. All patients who underwent bladder augmentation or ileal conduit diversion between 1998 and 2005 with a diagnosis consistent with spina bifida were included in the study.

Results: Bladder augmentation was performed in an estimated 3,403 patients and ileal loop diversion in 772 with spina bifida between 1998 and 2005. Patients fell into 2 clinically distinct populations. Those patients undergoing bladder augmentation tended to be younger (mean age 16 vs 36 years, $p < 0.001$) and male (52% of bladder augmentations vs 43% of urinary diversions, $p = 0.02$), and to have private insurance (46% vs 29%, $p < 0.001$) compared to those undergoing urinary diversion. Furthermore, patients undergoing urinary diversion required more health care resources, with significantly longer hospital stays, higher total charges and more use of home health care after discharge home.

Conclusions: Augmentation cystoplasty is widely used in the surgical management of neurogenic bladder in patients with spina bifida, although ileal loop diversion is still performed in a substantial proportion with clinically distinct characteristics.

Key Words: spinal dysraphism; urinary bladder, neurogenic; urologic surgical procedures

Abbreviation and Acronym

NIS = Nationwide Inpatient Sample

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SPINA bifida, or myelomeningocele, is the most common permanently disabling birth defect in the United States, with an incidence of 7 cases in 10,000 live births.[1] More than 90% of patients with spina bifida have resultant neurogenic bladder dysfunction,[2] which can manifest as urinary incontinence, recurrent urinary tract infections and, in the most severe cases, upper urinary tract damage. Renal insufficiency is also common in patients with spina bifida, affecting up to 30% of adolescents with the condition.[3]

Urodynamic evaluation allows the characterization of bladder dysfunction and guides therapy of socially unacceptable incontinence and/or potential renal insult. A significant proportion of patients with spina bifida have

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reduced bladder capacity. More serious is the high pressure bladder caused by increased leak point pressure, reduced bladder compliance and/or detrusor overactivity. First line therapy for reduced bladder capacity and/or high-pressure bladder is anticholinergic medication, usually with clean intermittent catheterization. If this approach fails or is not tolerated by the patient, second line options include a variety of experimental procedures such as botulinum toxin injection, electrical stimulation therapy, urethral dilation and bladder autoaugmentation. In refractory cases the bladder can be augmented or urine can be diverted from the bladder. These surgical approaches may be necessary in 11% to 17% of patients.[2]

Bladder augmentation and urinary diversion reduce pressure to the upper tracts and prevent further renal damage. However, the procedures have several drawbacks. For patients who undergo ileal loop urinary diversion these drawbacks include altered body image, management of an external appliance, and the potential for recurrent pyelonephritis, nephrolithiasis and delayed anastomotic stricture. Most patients who undergo bladder augmentation require intermittent catheterization that may limit their independence. Complications of bladder augmentation include metabolic derangement, bladder stones, recurrent urinary tract infection, bladder perforation and increased risk of malignancy.[4] The choice between urinary diversion and bladder augmentation is complex for surgeons and patients. Surgeon factors include comfort with the surgical technique and resources for subsequent management. For patients and their families important considerations include body image, social and cultural issues, ability to perform intermittent catheterization, anticipated compliance with long-term followup, renal function and overall health.

Most data on the decision between bladder augmentation and urinary diversion are from single institution studies. A database analysis of 35 pediatric hospitals in the United States identified 665 children with spina bifida undergoing bladder augmentation between 1999 and 2004, with an annual average of 4 procedures per hospital.[5] However, little is known about the use of bladder augmentation among adults or about urinary diversion among patients of any age. Therefore, we analyzed data from a nationally representative, all payer, all ages database to gain a broader perspective. We hypothesized that bladder augmentation is performed more commonly than urinary diversion among patients of all ages with spina bifida and that patient characteristics differ between patients undergoing these procedures.

MATERIALS AND METHODS

Data Source

Data are from the Nationwide Inpatient Sample, part of the Healthcare Cost and Utilization Project, a federal-state-industry partnership sponsored by the Agency for Healthcare Research and Quality.[6] The NIS includes data from a 20% stratified sample of discharges from approximately 1,000 community hospitals in more than 30 states. The sampling frame encompasses approximately 90% of all hospital discharges in the United States. The NIS is the only national hospital database to include information on all patients regardless of payer, specifically including patients with Medicare, Medicaid or private insurance as well as the uninsured. Primary and secondary diagnoses, primary and secondary procedures, hospital admission and discharge status, length of stay, hospital characteristics (eg size, teaching status), patient demographic characteristics, total charges and expected sources of payment are among the elements included in the data set. The institutional review board of Duke University Health System determined that this study was exempt from the requirement for approval.

Study Population and Covariates

We identified patients undergoing bladder augmentation (ICD-9-CM procedure code 57.87) or ileal loop urinary diversion (56.51) who also had an ICD-9-CM diagnosis code for spina bifida (ie 344.61, 741.0, 741.00, 741.01, 741.02, 741.03, 741.9, 741.90, 741.91, 741.92, 741.93, 742.59, 756.13 or 756.17). We used data from the 1998 through 2005 cohorts of the NIS to generate national estimates of procedure use. We used patient demographic characteristics (ie age, gender and race) as recorded in the NIS. Approximately 25% of observations in the NIS are missing data for patient race. Variables for primary payer (ie Medicare, Medicaid, private insurance and missing/other), hospital geographic region, hospital teaching status and rural or urban hospital location were used as reported in the NIS data set. In-hospital outcomes included length of stay, total charges, mortality and use of home health care services at discharge home.

Statistical Analysis

We used SAS® statistical software version 9.1 to generate national estimates with an ultimate cluster variance model to account for the complex survey design of the NIS. We used NIS sample weights for all analyses. We used Rao-Scott chi-square tests to compare categorical outcomes and z tests to compare continuous outcomes. To assess statistical significance we used 2-sided tests and $\alpha = 0.05$.

RESULTS

A total of 4,175 patients with spina bifida in the NIS database underwent bladder augmentation or ileal loop urinary diversion between 1998 and 2005 (table 1). Of these patients 3,403 (81.5%) underwent bladder augmentation and 772 (18.5%) underwent ileal loop urinary diversion. Mean (SE) patient age at surgery was 16 (0.6) years old in the bladder augmentation