National Trends in Augmentation Cystoplasty in the 2000s and Factors Associated with Patient Outcomes

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Abbreviations and Acronyms

AC = augmentation cystoplasty
BEEC = bladder exstrophy-epispadias complex
HCUP = Healthcare Cost and Utilization Project
ICC = interclass correlation coefficient
KID = Kids' Inpatient Database
LOS = length of stay
NB = neurogenic bladder
PHIS = Pediatric Health and Information System
SB = spina bifida
THC = total hospital charge
US = United States

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See Editorial on page 1159.

Purpose: Augmentation cystoplasty is a major surgery performed by pediatric urologists. We evaluated national estimates of children undergoing augmentation cystoplasty in the United States for trends during the 2000s, and analyzed patient and hospital factors associated with outcomes.

Materials and Methods: Patients who underwent augmentation cystoplasty registered in the 2000 to 2009 Kids' Inpatient Database were included. Estimates of total number of augmentation cystoplasties performed and patient and hospital characteristics were evaluated for trends. Hierarchical models were created to evaluate patient and hospital factors associated with length of stay, total hospital charges and odds of having a postoperative complication.

Results: An estimated 792 augmentation cystoplasties were performed in 2000, which decreased to 595 in 2009 ($p = 0.02$). Length of stay decreased from 10.5 days in 2000 to 9.2 days in 2009 ($p = 0.04$). A total of 1,622 augmentation cystoplasties were included in the hierarchical models and 30% of patients had a complication identified. Patient factors associated with increased length of stay and increased odds of any complication included bladder exstrophy-epispadias complex diagnosis and older age. Pediatric hospitals had 31% greater total hospital charges (95% CI 7–55).

Conclusions: The estimated number of augmentation cystoplasties performed in children in the United States decreased by 25% in the 2000s, and mean length of stay decreased by 1 day. The cause of the decrease is multifactorial but could represent changing practice patterns in the United States. Of the patients 30% had a potential complication during hospitalization after augmentation cystoplasty. Older age and bladder exstrophy-epispadias complex diagnosis were associated with greater length of stay and increased odds of having any complication.

Key Words: bladder exstrophy, spinal dysraphism, urinary bladder, urologic surgical procedures

Augmentation cystoplasty is a major surgery performed in children. Indications for augmentation cystoplasty include neurogenic and nonneurogenic bladder dysfunction after failure of conservative therapies, including clean intermittent catheterization, anticholinergic medication and intravesical therapies. In the pediatric population congenital anomalies such as spina bifida, bladder exstrophy-epispadias complex and other causes of neurogenic bladder are the most common underlying diagnoses.

After initial expansion of AC as a treatment for bladder dysfunction in children in the 1980s and 1990s, reports regarding complications following

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AC began to raise concerns. Studies regarding the risk of malignancy after AC have shown varied results,[1–4] with some revealing a risk of the potentially fatal complication of spontaneous bladder perforation postoperatively.[5–7] There have also been concerns about the effect of AC on metabolic parameters, bone mineral density and linear growth.[8–10]

Conservative therapies for bladder dysfunction have also increased through time with the increased availability of anticholinergic medications and intravesical botulinum toxin injections.[11–15] In the United Kingdom a 38% decrease in number of ACs performed was seen between 2000 and 2010, which could be a result of increased concern regarding complications and/or increased use of conservative treatment.[16] Another reason for the decrease may be a decline in the incidence of abnormalities such as SB.[17] In contrast, a study in the United States using the PHIS database from 1999 to 2004 demonstrated a stable rate of ACs performed in the US, and suggested that the increased focus on conservative therapy is not correlated with decreased use of AC in this country.[18]

Patient outcomes during hospitalization following AC, including LOS, mortality, complications, discharge status and total hospital charges, have not been reported extensively using national data sets. Presumably patient and hospital factors may be associated with these outcomes, as in other diseases. The main goal of this study was to use a national database to test the hypothesis that the number of ACs performed in the US declined in the 2000s. The secondary goal was to test the hypothesis that patient and hospital factors are associated with outcomes such as LOS, total hospital charges and complications during hospitalization following AC.

METHODS

Database

This study used the Kids' Inpatient Database (Healthcare Cost and Utilization Project, Agency for Healthcare Research and Quality). A list of organizations that contribute to the HCUP databases is available at http://www.hcup-us.ahrq.gov/partners.jsp. Data for KID have been collected every 3 years, starting in 1997. KID is generated by systematic random sampling of 80% of all pediatric discharges from state inpatient databases. A state inpatient database contains all or nearly all hospital discharges in that state. There were 27 states participating in 2000, which increased to 44 in 2009.

Each observation is assigned a stratum by geographic and hospital characteristics. A discharge weight is calculated for each stratum by dividing the number of American Hospital Association universe discharges in that stratum (obtained from Annual Survey of Hospitals data) by the number of KID discharges in the stratum. Discharge weights can be used to create national estimates. KID is described in detail elsewhere.[19] After 1997 hospitals were given a unique identifier. The years included in this analysis were 2000, 2003, 2006 and 2009, with 1997 excluded due to lack of unique hospital identifier for hierarchical modeling and differences in sampling explained in detail elsewhere.[19]

Identification of Patients and Diagnosis

Patients who underwent AC were identified by ICD-9 procedure code (57.87). Patients were considered to have a primary diagnosis of BEEC if listed (753.2, 752.62). A primary diagnosis of SB was assigned if listed (741.0x, 741.9x, 756.17) and BEEC was not. A primary diagnosis of NB (596.5x, 344.61) was assigned if listed and BEEC and SB were not. A primary diagnosis of other was assigned if a diagnosis of BEEC, SB or NB was not listed.

National Estimates

National estimates were generated for the number of ACs performed yearly, proportion of ACs performed in pediatric hospitals, gender distribution, racial distribution, diagnosis distribution, proportion of all admissions by diagnosis with AC and payer distribution. To test for trends during the years, weighted least squares regression was used, with weights being the inverse of the variance of each estimate and year as an independent variable.[20,21]

Predictors of Outcomes

Outcomes available in KID include LOS, total hospital charges, diagnosis and procedure codes for complications, discharge status and death. THCs are the total amount the hospital billed for the admission. Multivariate hierarchical models were used to evaluate the association of hospital and patient factors with outcomes. The unique hospital identifier was considered a random effect, while other variables were considered fixed effects. For each year of KID the hospitals were divided into volume quartiles based on number of ACs performed that year. Year of surgery was included as a categorical variable.

Multivariate hierarchical linear models were used for the outcomes of LOS and THCs. Distributions of LOS and THCs were right skewed and were natural log transformed to conform to a normal distribution. LOS was included in the model for THCs. Interclass correlation coefficient was calculated for LOS and THCs. A multivariate hierarchical logistic model was created to evaluate patient and hospital factors associated with odds of having any complication. A model was planned for factors associated with discharge status. However, more than 98% of patients were discharged home, and this was not modeled.

RESULTS

National Estimates

Table 1 outlines the national estimates. In 2000 there were 792 ACs performed, which showed a decreasing trend to 595 in 2009, for a decrease of 25%. The proportion of all SB admissions where an AC was performed decreased from 2.7% in 2000 to