Trends in inpatient prolapse procedures in the United States, 1979–2006

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OBJECTIVE: We sought to describe national trends for inpatient procedures for pelvic organ prolapse from 1979–2006.

STUDY DESIGN: The National Hospital Discharge Survey was analyzed for patient and hospital demographics, as were *International Classification of Diseases, Ninth Revision, Clinical Modification* diagnostic and procedures codes from 1979–2006. Age-adjusted rates (AARs) per 1000 women were calculated using the 1990 US Census data.

RESULTS: There was a significantly decreasing trend in the AARs for inpatient prolapse procedures, from 2.93–1.52 per 1000 women from 1979–2006. AARs for hysterectomy decreased from 8.39–4.55 per 1000 women from 1979–2006. Over the study period, AARs remained at about the 1979 level among the women ≥52 years old (2.73–2.86; $P = .075$). In women <52 years old, AARs declined to less than one-third of the 1979 rate (3.03–0.84; $P < .001$).

CONCLUSION: AARs for inpatient procedures for prolapse in the United States remained stable for women aged ≥52 years from 1979–2006; rates declined by two-thirds for women aged <52 years.

Key words: hospital discharge database, pelvic organ prolapse

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Pelvic organ prolapse has emerged as an important and common medical problem affecting 1 in every 10 women in the United States.[1] There is an 11% risk of undergoing surgery for prolapse or incontinence by age 80 years,[2] with a 30% risk of reoperation.[3] The direct cost of surgery is >$1 billion each year,[4] with an estimated 200,000 surgical procedures performed annually.[3] A recent observational study noted that >50% of women presenting for routine gynecologic care have prolapse stage ≥II.[5]

The magnitude of the problem continues to progress with the changing population demographics.[6] The US Census Bureau projects that the number of US women aged ≥65 years will double within the next 25 years to >40 million by the year 2030.[7] By 1 estimate, the demand for health care services related to prolapse will increase at twice the rate of the population itself.[8]

The incidence of hospital admissions associated with pelvic organ prolapse has been reported as 2.04 per 1000 person-years.[9] A study by Boyles et al[3] noted a slow but steady decline in rates of procedures in women aged <50 years from 1979–1997. This finding is in contrast to the increase in surgical procedures for stress urinary incontinence seen since 1979.[10] Racial disparities appear to exist in women undergoing prolapse surgery, but data are conflicting.[11]

The goal of this study is to describe national trends in surgery for prolapse from 1979–2006 using the National Hospital Discharge Survey (NHDS) database. The secondary objectives were to examine patient demographics, comorbidities, and surgical complications.

Materials and Methods

Methods have been previously described.[10] Deidentified data were abstracted from the NHDS, a federal dataset utilizing a multistate probability sampling of inpatient hospital discharges in the United States. Medical records from 466 nonfederal short-stay hospitals, approximately 8% of all US hospitals, were selected by systematic random sampling. Approximately 270,000 discharges were collected per year from January 1979–December 2006. The survey recorded up to 7 discharge diagnosis codes and 4 procedure codes, using the *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*) coding system. Other deidentified information collected included patient sex, age, race, and marital status; length of hospital stay; hospital size (number of beds); hospital ownership; and insurance type or expected source of payment. Quality-control programs have estimated the error rate for the NHDS at 4.3% for medical coding and data entry and 1.4% for demographic coding and data entry.[12]

After obtaining institutional review board-exempt approval status, data on women who underwent surgical correc-

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TABLE 1
***International Classification of Diseases, Ninth Revision, Clinical Modification* diagnosis codes for prolapse**

Code
618 Genital prolapse
618.0 Prolapse of the vaginal walls without mention of uterine prolapse
618.00 Unspecified prolapse of vaginal walls
618.01 Cystocele midline
618.02 Cystocele lateral
618.03 Urethrocele
618.04 Rectocele
618.05 Perineocele
618.09 Other uterine prolapse without mention of uterine prolapse/cystourethrocele
618.1 Uterine prolapse without mention of vaginal wall prolapse
618.2 Uterovaginal prolapse, incomplete
618.3 Uterovaginal prolapse, complete
618.4 Uterovaginal prolapse, unspecified
618.5 Prolapse of vaginal vault after hysterectomy
618.6 Vaginal enterocele, congenital or acquired
618.7 Old laceration of muscles of the pelvic floor
618.8 Other specified genital prolapse
618.81 Incompetence or weakening of pubocervical tissue
618.82 Incompetence or weakening of rectovaginal tissue
618.83 Pelvic muscle wasting
618.84 Cervical stump prolapse
618.89 Other specified genital prolapse
618.9 Unspecified genital prolapse

Jones. Trends in inpatient prolapse procedures in the US, 1979–2006. Am J Obstet Gynecol 2010.

tion of prolapse from 1979–2006 were identified using the *ICD-9-CM* codes outlined in Table 1. All women undergoing ≥1 of these procedures (Table 2) were included in the analysis. Tabulated surgical procedure numbers were then inflated to national averages using specifically designated hospital weights, which are included in the federal dataset for each patient discharge. Age-adjusted rates (AARs) of procedures per 1000 women were calculated by the direct method of rate adjustment, using the 1990 projected US Census population data for each year of age. Data were stratified by patient age <52 or ≥52 years, a division chosen based on average age of menopause in the United States. Hysterectomies performed for benign indications were used as a reference. We included abdominal, vaginal, and laparoscopically performed hysterectomies. We chose this as a reference, because hysterectomy performed for benign indications is the most commonly performed major gynecologic procedure and would serve as clinical marker to keep rates of prolapse procedures in perspective of other gynecologic procedures.[13] In addition, hysterectomy is commonly performed at the time of prolapse procedures and may serve as a predictor of changing trends in prolapse procedures. When the estimated number of cases per year was based on <60 records in the database, the estimate was considered unreliable. The linear test of trend was used to assess trends in the AARs of procedures from 1979–2006. The SE of the AARs was calculated using the approximation equation:[14] SE = $\frac{R}{\sqrt{n}}$, where R is the AARs and n is the number of events. Statistical analysis was performed using software (SPSS, version 15.0; SPSS, Inc, Chicago, IL). A P value $< .05$ was considered statistically significant.

Results

According to NHDS data, approximately 5,632,900 inpatient procedures for prolapse were performed in the United States from 1979–2006. The number of women undergoing prolapse procedures decreased from 231,100 in 1979 to 186,900 in 2006. AARs of prolapse surgery per 1000 women also decreased, from 2.93 in 1979 to 1.52 in 2006 (Figure 1). When stratified by age, the AAR for women aged ≥52 years was 2.73 in 1979 and 2.86 in 2006, while in women aged <52 years the AAR declined from 3.03–0.84 (Figure 2). As a reference, AARs for hysterectomy performed for benign indications were calculated. AARs for hysterectomy decreased from 8.39–4.55 per 1000 women from 1979–2006. In women aged <52 years, there was a significant decrease in AARs of hysterectomy, from 10.78–5.20 per 1000 women from 1979–2006 ($P < .001$); for women aged ≥52 years there was also a significant, but less marked, change in AAR of hysterectomy, from 3.73 in 1979 to 3.29 ($P = .006$) in 2006 (Figure 2). Change in trend for AARs for both prolapse procedures and hysterectomy decreased in women <52 years old ($\beta = -0.065$ and -0.201, respectively; $P < .001$), while there was a small, yet significant, change in trend for these procedures in women ≥52 years old ($\beta = 0.012$ and -0.020, respectively; $P = .075$, $P = .006$).

The mean age of women undergoing prolapse procedures in this study was 53.2 ± 15.4 years, with the mean age increasing from 47.5 ± 15.0 years to 57.3 ± 14.1 years over the 27-year study period. Of these women, 77% were white, 4% black, and 19% other or not stated. Geographic distribution of procedures re-