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National trends of adnexal surgeries at the time of hysterectomy for benign indication, United States, 1998–2011

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OBJECTIVE: We sought to investigate the most recent national trends of bilateral salpingectomy (BS) and bilateral salpingo-oophorectomy (BSO) at the time of hysterectomy performed for benign indications.

STUDY DESIGN: We conducted a national cross-sectional analysis of all inpatient discharges for women aged ≥ 18 years who underwent a hysterectomy for benign indications from 1998 through 2011 using the largest publicly available all-payer inpatient database in the United States. We scanned *International Classification of Diseases, Ninth Revision* codes for an indication of specific bilateral adnexal surgeries, including BSO and BS. Joinpoint regression was used to characterize and estimate 14-year national trends in performing BSO and BS at the time of hysterectomy for benign indications, overall and in population subgroups.

RESULTS: During the study period, there were approximately 428,523 inpatient hysterectomy procedures performed annually for benign indications. Of these, $>53\%$ had no adnexal surgery performed during the same hospitalization, whereas 43.7% and 1.3% of those discharges had BSO and BS procedures, respectively. The rate of BSO

was directly correlated with increasing age for patients <65 years. Conversely, we observed an inverse relationship between BS and patient age, with the BS rate among women aged <25 years twice that of women aged ≥ 45 years. From 1998 through 2001, there was a 2.2% increase in the rate of BSO per year (95% confidence interval, 0.4–4.0); however, this was followed by a consistent 3.6% (95% confidence interval, -4.0 to -3.3) annual decline in the BSO rate, from 49.7% in 2001 to 33.4% in 2011. National rates of BS among women undergoing hysterectomy for benign indications increased significantly throughout the study period, with an estimated 8% annual increase from 1998 through 2008, followed by a sharp 24% increase annually during the last 4 years of the study period. The BS rate nearly quadrupled in 14 years.

CONCLUSION: The type of adnexal surgery performed concomitantly with hysterectomy for benign indications has undergone a significant shift since 2001. Significantly more BS and less BSO procedures are being performed among gynecologic surgeons in the United States.

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BACKGROUND AND OBJECTIVE

Adnexal surgery at the time of hysterectomy performed for benign indications is a crucial component of preoperative patient counseling and decision making. Compared with ovarian conservation, bilateral oophorectomy at the time of hysterectomy for benign disease is associated with a decreased risk for breast

and ovarian cancer, but an increased risk of all-cause mortality, fatal and nonfatal coronary heart disease, and lung cancer. Recently, studies have confirmed the belief that most pelvic serous carcinomas originate from the distal fallopian tube.

The objective of this study was to investigate the most recent national trends of bilateral salpingectomy (BS)

and bilateral salpingo-oophorectomy (BSO) performed at the time of a hysterectomy procedure for benign indications.

MATERIALS AND METHODS

A cross-sectional analysis of all inpatient hospital discharges from 1998 through 2011 was conducted using the National

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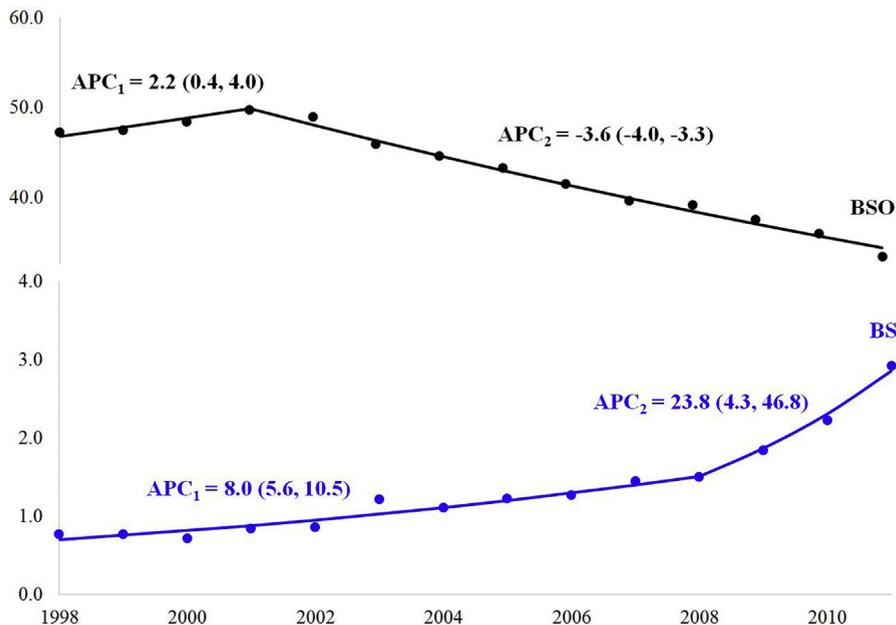
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FIGURE

National trends of BSO and BS during benign hysterectomy in US, 1998-2011



Trends in bilateral salpingo-oophorectomy (BSO) and bilateral salpingectomy (BS) among inpatient discharges in which hysterectomy was performed due to benign indications, Healthcare Cost and Utilization Project—Nationwide Inpatient Sample, 1998 through 2011. The 14-year temporal trends in BSO and BS during study period. Circular markers indicate observed annual rate, whereas solid lines represented trends estimated by joinpoint regression. X-axis, Year of discharge; Y-axis, percentage of hysterectomies in which procedure was performed (axis is split to account for substantial differences in rates across procedure types).

APC, annual percent change, point estimate (95% confidence interval).

Mikhail. National trends of adnexal surgeries. *Am J Obstet Gynecol* 2015.

Inpatient Sample, the largest publicly available all-payer inpatient database in the United States, made available by the Healthcare and Cost Utilization Project. The study population consisted of inpatient discharges for women aged ≥ 18 years who underwent a hysterectomy for benign indications.

Clinical diagnoses and surgical procedures were identified according to the *International Classification of Diseases, Ninth Revision, Clinical Modification*. After identifying the study population, we scanned procedure codes in each discharge record for bilateral adnexal surgeries, including BSO and BS.

Unilateral procedures were not considered. Patient age was classified into 6 categories. Clinical characteristics included the route of hysterectomy performed (laparoscopic, vaginal, or

abdominal) and the indication(s) for it. We considered several hospital characteristics, including geographic region, location (urban vs rural), and teaching status.

Joinpoint regression was used to investigate and describe 14-year national trends in performing salpingectomy and oophorectomy at the time of hysterectomy for benign indications. Annual percent change (APC) was calculated to describe how the rate changes within each time interval.

RESULTS

Of an estimated 428,523 such procedures done in the United States each year during the study period, $>53\%$ of hysterectomy procedures were not accompanied by adnexal surgery during the same hospitalization, whereas 43.7%

and 1.3% of discharges had BSO and BS, respectively.

Women aged 35-54 years comprise $>75\%$ of all US women who underwent a hysterectomy for benign indications. Patient age was the factor most strongly associated with the primary outcome ($P < .0001$). The rate of BSO was directly correlated with increasing age for patients <65 years, with $>60\%$ of women aged 45-64 years undergoing BSO vs $<20\%$ of women aged <35 years. We observed an inverse relationship between BS and patient age, with the BS rate among women aged <25 years twice that of women aged ≥ 45 years.

The route of hysterectomy seems to have an impact on the rate of BS. During years in which more specific *International Classification of Diseases, Ninth Revision, Clinical Modification* codes permitted complete differentiation of hysterectomies according to route (2007 through 2011), laparoscopic hysterectomy was associated with statistically significantly higher rates of BS (4.2% in 2011) compared to abdominal (2.6%) or vaginal (1.7%) hysterectomy. Non-laparoscopic vaginal hysterectomy was much less likely to be accompanied by any adnexal surgery (16.7% in 2011) than were laparoscopic (40.3%) or abdominal (45.2%) procedures.

We observed significant changes in the trends of adnexal procedures in our study population during the study period (Figure). From 1998 through 2001, there was a 2.2% increase in the rate of BSO per year (95% confidence interval, 0.4–4.0); however, this was followed by a consistent 3.6% (95% confidence interval, -4.0 to -3.3) annual decline in the BSO rate, from 49.7% in 2001 to 33.4% in 2011. National rates of BS among women undergoing hysterectomy for benign indications increased significantly throughout the study period, with an 8% annual increase from 1998 through 2008, followed by a sharp 24% annual increase during the last 4 years of the study period. The BS rate nearly quadrupled in 14 years. The trend of declining BSO rates were fairly consistent across all women aged 25-64 years, although APCs were more pronounced in premenopausal and perimenopausal women (APC, -5.8 and

−4.9, respectively). Similarly, increasing BS rates were observed in every age group <65 years. The rate of BS among women aged 25-34 years doubled in just 4 years.

COMMENT

We identified a significant change in the types of adnexal surgery performed at the time of hysterectomy for benign indication. It is evident from our study that the number of concurrent BSO has consistently and significantly declined since 2001. On the other hand, the number of concomitant BS has steadily increased since early 2000, with exponential and significant increase since 2008.

The role of the fallopian tube in the pathogenesis of ovarian cancer has been studied extensively. In agreement with the link between ovarian cancer and fallopian tubes, gynecologic surgeons have demonstrated a significant shift toward the performance of more BS

during hysterectomy done for benign indications as opposed to BSO.

Due to the risks of oophorectomy, it is not generally recommended that young premenopausal women at low risk for ovarian cancer undergo BSO at time of hysterectomy unless clinically indicated. While there are currently no clear recommended national guidelines with respect to this surgical practice, it is clearly seen in this adequately powered study that gynecologic surgeons have gradually adopted this practice.

Concomitant BS during hysterectomy does not seem to increase perioperative morbidity. A universal shift in the types of adnexal surgery performed during hysterectomy for benign indications in the United States is evident from this study. Whether this change in practice pattern would effectively reduce the burden of ovarian cancer while allowing women to preserve ovarian function or trends for ovarian preservation will

increase the need for subsequent surgery for benign adnexal indications remains to be seen through subsequent studies.

CLINICAL IMPLICATIONS

- The proportion of concurrent bilateral salpingo-oophorectomy procedures performed during benign hysterectomy has significantly declined since 2001.
- The proportion of concurrent bilateral salpingectomy procedures performed during benign hysterectomy has steadily increased since early 2000, with exponential and significant increase since 2008.
- The factor most strongly associated with the type of adnexal surgery performed was patient age.
- The route of hysterectomy has an impact on the rate of bilateral salpingectomy. ■

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