UC Davis
UC Davis Previously Published Works

Title

Successful completion of total and partial salpingectomy at the time of cesarean delivery

Permalink

Journal

ISSN

Authors

Lehn, Kristiana
Gu, Linda
Creinin, Mitchell D
et al.

Publication Date

DOI

Peer reviewed
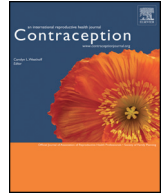
Original research article

Successful completion of total and partial salpingectomy at the time of cesarean delivery ☆,☆☆

Kristiana Lehn [a], Linda Gu [a], Mitchell D. Creinin [a,b], Melissa J. Chen [a,b,*]

[a] University of California, Davis School of Medicine, Sacramento, CA 95817
[b] Department of Obstetrics and Gynecology, University of California, Davis, Sacramento, CA 95817

ABSTRACT

Objective: Evaluate completion of partial or total salpingectomy during Cesarean delivery based on intended procedure.
Study design: We conducted a retrospective study of women who had a permanent contraception procedure during Cesarean delivery at an urban, academic hospital from November 2015 through April 2017. We reviewed all charts of women who had a Cesarean delivery to identify those who underwent concomitant tubal surgery, including both completed and attempted procedures. We compared demographic, medical, and obstetric characteristics of participants by planned and completed method using univariate analysis.
Results: We identified 122 women who underwent Cesarean delivery with planned concurrent permanent contraception procedure. Thirty-two (26.2%) women preferred partial salpingectomy and 90 (73.8%) preferred total salpingectomy. All women who desired partial salpingectomy had the procedure performed. However, 17 (18.9%) women desiring total salpingectomy could not have the procedure performed bilaterally: nine underwent a mixed procedure and seven underwent bilateral partial salpingectomy because of adhesions, engorged vasculature, or unspecified reasons. One woman had significant adhesive disease preventing any procedure. Among women who planned a total salpingectomy, having ≥3 Cesarean deliveries was the only factor associated with needing an alternative procedure (P=.04).
Conclusion: As interest in total salpingectomy for permanent contraception increases, surgeons should counsel women who are interested in total salpingectomy at time of Cesarean delivery that adhesions and tubal proximity to adjacent vessels may preclude completion of bilateral tubal removal and discuss alternative options prior to surgery.
Implications: Interest in bilateral total salpingectomy for permanent contraception at the time of Cesarean delivery is increasing; accordingly, surgeons should counsel patients that adhesions and proximity to large vessels may preclude completion of bilateral total salpingectomy, especially in women who have had multiple prior Cesarean deliveries.

1. Introduction

In the last decade, fallopian tube removal has emerged as an approach for reducing the risk of ovarian cancer in the absence of an effective screening strategy for this deadly disease [1]. Several studies have demonstrated increasing utilization of total salpingectomy during hysterectomy or laparoscopic interval sterilization [2–6]; however, postpartum total salpingectomy is performed much less commonly [6].

Postpartum permanent contraception procedures occur after 8–9% of hospital deliveries [7], and about 75% of procedures take place during Cesarean delivery [8]. Therefore, expanding the practice of total salpingectomy for women seeking concomitant permanent contraception with Cesarean delivery has the potential to affect over 300,000 women per year [8]. In addition to ovarian cancer risk reduction, total removal of the fallopian tubes offers nearly 100% contraceptive efficacy, while also reducing the risk of ectopic pregnancies after tubal surgery [9]. In contrast, partial salpingectomy, the traditional method of postpartum female permanent contraception, has a 10-year cumulative failure rate of 7.5 pregnancies per 1000 procedures [10].

Despite these benefits, providers may be concerned about surgical risks with postpartum total salpingectomy, especially those related to engorged mesosalpinx vasculature [9, 11]. Currently, small studies report a slightly longer operative time without an increase in complications when the procedure is successfully completed [6, 12–14]. However, limited data exist describing how often and why total

salpingectomy procedures are unable to be completed at the time of Cesarean delivery [13, 14]. As more clinicians adopt total salpingectomy, information regarding the likelihood of successful completion of bilateral total salpingectomy and differences in safety outcomes between completed and attempted procedures is important to discuss with patients during counseling. In this study, we evaluate the successful completion and safety outcomes of partial and total salpingectomy at the time of Cesarean delivery based on intended procedure.

2. Materials and methods

We performed this retrospective study of all women who underwent a permanent contraception procedure during Cesarean delivery at University of California, Davis Medical Center from November 2015 through April 2017. This time period represents the first 18 months after performing the initial Cesarean delivery with total salpingectomy for permanent contraception. This procedure occurred after family planning specialists collaborated with obstetric providers to increase clinician awareness of total salpingectomy as an option for permanent contraception at Cesarean delivery and to

incorporate standardized patient education tools regarding different permanent contraception methods. The University of California, Davis Institutional Review Board approved this study.

We identified women who had a Cesarean delivery during the study period using the Labor and Delivery Operating Room record, which included both scheduled and unscheduled surgeries. We reviewed all charts to identify women who underwent Cesarean delivery with concomitant tubal surgery, including both completed and attempted procedures. We excluded women who had a peripartum hysterectomy.

Two authors (K.L., L.G.) reviewed patient charts in the electronic medical record, and a third investigator (M.J.C.) confirmed the accuracy of abstracted data. We obtained demographic information (age, ethnicity/race, insurance status), medical co-morbidities, previous abdominal surgeries, obstetric history (gravidity, parity, number of prior Cesarean delivery), smoking status, and body mass index (BMI) at time of delivery. The primary outcome of the study is the proportion of permanent contraception procedures completed as planned. We reviewed both preoperative documentation (e.g., prenatal care notes, history and physical, and consent form) and the operative report to determine the type of permanent contraception procedure planned and

Table 1
Demographic, obstetric, and medical characteristics by planned and completed procedure in women desiring permanent contraception at Cesarean delivery

Characteristic	Planned and completed partial salpingectomy (n=32)	Planned and completed total salpingectomy (n=73)	Planned total salpingectomy and completed partial, mixed, or no procedure (n=17)*	p-value comparing all three groups	p-value comparing women who planned total salpingectomy
Age (years)	33 (26.5–37)	34 (32–38)	32 (29–36)	.28[†]	.17[‡]
BMI (kg/m²) at delivery	33.1 (29.0–39.6)	33.4 (28.7–38.9)	34.2 (30.0–36.6)	.89[†]	.74[‡]
Obese (BMI≥30)	20 (62.5)	52 (71.2)	13 (76.5)	.59[§]	.77[‖]
Race/ethnicity					
White	10 (31.3)	33 (45.2)	5 (29.4)	.21[‖]	.36[‖]
Hispanic	11 (34.4)	30 (41.1)	7 (41.2)		
African American	3 (9.4)	5 (6.8)	3 (17.6)		
Asian and Pacific Islander	6 (18.8)	4 (5.5)	2 (11.8)		
Other or missing	2 (6.3)	1 (1.4)	0		
Publicly Insured	20 (62.5)	37 (50.7)	12 (70.6)	.26[§]	.18[‖]
Gravidity	4 (2.5–6)	4 (3–5)	4 (3–5)	.94[†]	.88[‡]
Parity	2 (1–3)	2 (1–3)	2 (1–3)	.84[†]	.64[‡]
Number of prior Cesarean deliveries					
0	9 (28.1)	20 (27.4)	1 (5.9)	.20[‖]	.04[‖]
1	12 (37.5)	27 (37.0)	8 (47.1)		
2	7 (21.9)	20 (27.4)	3 (17.6)		
3 or more	4 (12.5)	6 (8.2)	5 (29.4)		
Other abdominal surgery	8 (25.0)	16 (21.9)	1 (5.9)	.28[‖]	.18[‖]
Medical co-morbidities					
Autoimmune disease	0	1 (1.4)	1 (5.9)	.12[¶]	.42[#]
Chronic hypertension and hypertensive disorders in pregnancy	10 (31.3)	16 (21.9)	4 (23.5)		
Drug use	0	2 (2.7)	0		
Gestational diabetes	10 (31.3)	20 (27.4)	5 (29.5)		
Pre-gestational diabetes	3 (9.4)	8 (11.0)	2 (11.8)		
Pre-existing infection	1 (3.1)	1 (1.4)	1 (5.9)		
Pulmonary disease	7 (21.9)	9 (12.3)	3 (17.6)		
Renal disease	1 (3.1)	1 (1.4)	0		
Structural heart disease and/or heart failure	2 (6.3)	4 (5.5)	1 (5.9)		
Structural uterine diagnoses	4 (12.5)	4 (5.5)	1 (5.9)		
Vascular disease with or without anticoagulation	1 (3.1)	3 (4.1)	0		
None	12 (37.5)	43 (58.9)	8 (47.1)		
Multiple gestation	3 (9.4)	5 (6.8)	0	.59[‖]	.58[‖]
Smoking during pregnancy	3 (9.4)	1 (1.4)	1 (5.9)	.09[‖]	.34[‖]
Gestational age at delivery	38.6 (36.7–39.0)	39.0 (37.0–39.1)	38.1 (37.3–39.0)	.75[†]	.55[‡]
Scheduled delivery	17 (53.1)	51 (69.9)	12 (70.6)	.25[§]	>.99[‖]
Low transverse cesarean delivery	32 (100.0)	71 (97.3)	16 (94.1)	.50[‖]	>.99[‖]
Transverse skin incision	31 (96.9)	72 (98.6)	16 (94.1)	.35[‖]	.34[‖]

Data presented as n (%) or median (interquartile range).
* This group includes 7 women who had bilateral partial salpingectomy, 9 who had mixed total and partial salpingectomy, and 1 who was unable to have any permanent contraception procedure completed.
[†] Kruskal-Wallis test used to perform comparison.
[‡] Mann–Whitney U test used to perform comparison.
[§] chi-Square test used to perform comparison.
[‖] Fisher's Exact test used to perform comparison.
[¶] Each woman could have more than one medical-comorbidity. chi-Square test used to compare proportion of women with no medical co-morbidities among the groups.
[#] Each woman could have more than one medical-comorbidity. Fisher Exact test used to compare proportion of women with no medical co-morbidities among the groups.

confirmed the completed procedure using the operative report. Permanent contraception procedure type included total salpingectomy, partial salpingectomy, or mixed procedure (partial salpingectomy on one side and total salpingectomy on the other). We reviewed surgical pathology reports to confirm permanent contraception procedure completion.

Secondary outcomes include immediate surgical and post-operative complications and surgical time. We obtained the estimated blood loss (EBL) and intraoperative complications from the operative report. We defined surgical time as the number of minutes from initial incision to closure. We also reviewed charts for blood transfusion, post-operative hospitalizations greater than 4 days, surgical site infections, hospital readmission, and re-operation within 30 days of delivery. We considered a length of stay greater than 4 days after Cesarean delivery as an outcome of interest; 4 days is the 90th percentile of post-operative hospitalizations and women with prolonged stays more commonly experience perioperative morbidity [15].

We compared demographic, medical, and obstetric characteristics of participants by those who had a planned and completed partial salpingectomy, planned and completed total salpingectomy, and planned total salpingectomy but completed another procedure (i.e. partial, mixed, or no procedure). When comparing surgical outcomes, we only included women who were able to have a permanent contraception procedure completed. We used Chi-square and Fisher's exact tests to compare categorical variables and the Kruskal-Wallis and Mann–Whitney U tests to compare continuous variables without a normal distribution. We used SPSS 25 (IBM, Armonk, NY, USA) for statistical analysis and considered p<.05 to be statistically significant.

3. Results

During the study time period, 435 women underwent Cesarean delivery and all charts were available for review. The surgeon planned a concurrent permanent contraception procedure in 122 (28.0%) of these patients. We found no differences in demographic, obstetric, and medical characteristics by planned and completed tubal permanent contraception procedure (Table 1). Surgeons documented 32 (26.2%) women with a preference for partial salpingectomy and 90 (73.8%) for total salpingectomy. The proportion of planned total salpingectomy procedures increased from 50.0% in the first 3 months of the study period to 94.1% in the last 3 months (p<.01). All 32 women who desired a partial salpingectomy had the procedure performed. However, 17 (18.9%) women desiring total salpingectomy could not have the procedure performed bilaterally (Fig. 1). Nine (10.0%) had a mixed procedure due to adhesive disease (n=4), proximity to large vessels in mesosalpinx (n=3), or both (n=2). Seven (7.8%) women underwent bilateral partial salpingectomy due to adhesive disease (n=4), engorged vasculature (n=1), or unspecified reasons (n=2). One

woman had significant adhesive disease obscuring visualization of both fallopian tubes that prevented any procedure. Among women who planned total salpingectomy, those with three or more prior Cesarean deliveries were less likely to complete a bilateral total salpingectomy procedure as planned compared to women with fewer Cesarean deliveries (p=.04, Table 1).

The 122 surgeries involved 32 resident physicians, ranging from first year to fourth year, under the supervision of 18 different attending physicians. Sixteen general obstetrician/gynecologists performed 118 (96.7%) surgeries, and two perinatologists completed the remaining four procedures. There does not appear to be relationship between surgeon experience and completion of permanent contraception procedure as planned (Supplemental Table 1). Two surgeons used an electrothermal bipolar tissue sealing device to perform the total salpingectomy procedures; both of these patients had worsening heart failure precipitating delivery. The surgeons performed the remaining total salpingectomy procedures with a standard suture ligation technique or with monopolar cautery to create windows in the mesosalpinx followed by clamping across the mesosalpinx, suture ligation, and excision of the fallopian tube.

We found no differences in EBL, need for blood transfusion, or hospital readmission among the three groups based on planned and completed procedure (Table 2). Surgical time appears to increase with completion of partial salpingectomy to total salpingectomy to an alternative procedure; however, this finding was not statistically significant. Women who desired total salpingectomy but had a partial salpingectomy or mixed procedure were more likely to have a prolonged hospitalization compared to women who received their intended procedure (p<.01). One woman who underwent a mixed salpingectomy procedure due to adhesive disease had a history notable for mechanical replacement of her aortic valve on chronic anticoagulation; she had a prolonged hospitalization due to a rectus sheath hematoma requiring blood transfusion and re-operation. The remaining cases of prolonged hospitalization were for blood pressure management (n=3), ulcerative colitis (n=1), osteomyelitis (n=1), and heart failure (n=1). None of the complications appear to be directly related to the permanent contraception procedures (Supplemental Table 2).

4. Discussion

In our sample, adhesive disease and proximity to engorged vessels in the mesosalpinx precluded bilateral total salpingectomy in about 20% of planned procedures. The only factor associated with women desiring a total salpingectomy but needing an alternative procedure was having three or more prior Cesarean deliveries. As the likelihood of adhesions increases with each subsequent Cesarean delivery [16], clinicians and

Table 2
Surgical outcomes by planned and completed permanent contraception procedure at the time of Cesarean delivery

Outcome	Planned and completed partial salpingectomy (n=32)	Planned and completed total salpingectomy (n=73)	Planned total salpingectomy and completed partial or mixed procedure* (n=16)	p value
Surgical time (minutes)†	75.5 (62–91.5)	85 (71–99)	86.5 (80.5–93)	.16
EBL (mL)†	600 (500–925)	700 (500–800)	700 (500–875)	.94
EBL>1000 mL‡	4 (12.5)	5 (6.8)	2 (12.5)	.53
Blood transfusion‡	2 (6.3)	1 (1.4)	1 (6.3)	.21
Prolonged hospitalization (Discharge >POD4)§	1 (3.1)	2 (2.7)	4 (25.0)	<.01
Surgical site infection‡	2 (6.3)	2 (2.7)	1 (6.3)	.51
Hospital readmission	1 (3.1)	2 (2.7)	0	>.99

Data presented as n(%) or median (interquartile range).
EBL, estimated blood loss.
POD, post-operative day.
* Mixed procedure refers to total removal of fallopian tube on one side and partial removal of fallopian tube on the other side.
† Kruskal-Wallis test used to perform comparison.
‡ Fisher's Exact test used to perform comparison.
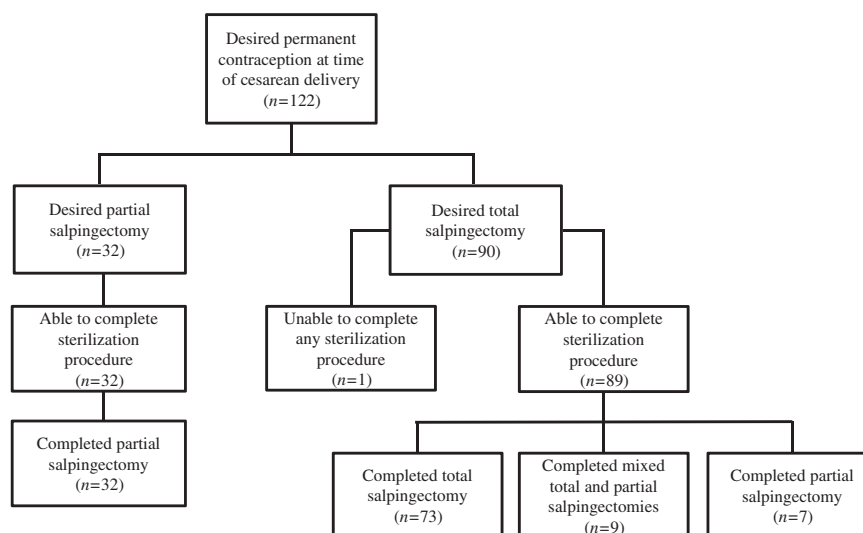§ Fisher's Exact test used to perform comparison.

Fig. 1. Intention and completion of partial and total salpingectomy for permanent contraception at time of Cesarean delivery.

patients should be prepared to complete an alternative tubal permanent contraception procedure or choose another contraceptive method if significant adhesions are encountered.

We found no differences in surgical outcomes among women who planned and completed partial salpingectomy, planned and completed total salpingectomy, or planned total salpingectomy and completed an alternative procedure, except for prolonged hospitalization in the latter group. However, this finding does not appear to be related to the permanent contraception procedure. The overall safety of total salpingectomy at Cesarean delivery demonstrated in this study is consistent with previous literature [6, 12–14]. Our findings also demonstrate the ability to perform total salpingectomy with suture ligation in medically complex patients at the time of both scheduled and unscheduled Cesarean deliveries without significantly increasing the risk of immediate surgical complications.

Our rate of conversion from total salpingectomy to an alternative procedure is higher than previously reported in smaller series. In one publication with 23 cases, two surgeons were able to perform a bilateral total salpingectomy using an electrosurgical device in all but two women, both due to pelvic adhesions [13]. In a randomized trial of total versus partial salpingectomy, two surgeons completed the intended procedure using suture ligation in all 22 participants allocated to bilateral salpingectomy [14]. In contrast to these studies, our study included multiple attending physicians, likely contributing to the differences in total salpingectomy completion rates. In addition, our sample was larger than previous studies, which allows for detection of the less frequent outcome of conversion to an alternative procedure.

In our institution, obstetricians adopted total salpingectomy over a relatively short period of time, potentially as a result of specialist-driven clinician education and standardized patient education tools for use during counseling. For comparison, in a large Northern California managed care system, total salpingectomy only occurred in 9% of permanent contraception procedures at Cesarean delivery at 3 years after introduction of a system-wide practice recommendation for providers [6]. A survey of American College of Obstetricians and Gynecologists members found that clinicians considered the risk of operative complications and increased operative time as barriers to performing bilateral salpingectomy at Cesarean delivery and that the risks generally outweigh the benefits [11]. Identifying advocates to lead educational efforts focusing on known safety outcomes and benefits of ovarian cancer risk reduction as well as greater contraceptive efficacy may facilitate more acceptance of postpartum total salpingectomy among physicians and patients.

A strength of our study is the ability to differentiate outcomes based on the intended procedure and not just the completed surgery through our systematic review of all Cesarean deliveries that occurred for the time period. Other retrospective studies identified participants by searching through databases for the completed procedures [6, 12]. This method may miss those who had an alternative or no procedure performed, which is potentially the reason a mixed procedure has not been previously described in the literature. Additional strengths of our study are the inclusion of medically complex patients, number of providers, and primary use of suture ligation techniques to remove the fallopian tubes, which broadens the generalizability of our findings to multiple settings. Limitations of this retrospective study include our inability to assess complications if patients presented outside of our medical system after hospital discharge. While we were able to determine the planned permanent contraception during chart review, we were unable to confirm the reasons for choosing one method or another. Based on the change in procedure preference over the study period, we believe that patient counseling may have changed as surgeons became more comfortable with performing total salpingectomy. Similarly, because we ascertained surgical difficulties through operative reports, our appreciation of the surgeon's comfort with navigating challenges with adhesions or adjacent vasculature during the procedures may be incomplete. Lastly, the sample is still relatively small to identify less frequent complications with either type of permanent contraception procedure.

Clinicians should consider total salpingectomy during Cesarean delivery for both ovarian cancer prevention and its greater contraceptive efficacy compared to partial salpingectomy [17, 18]. When counseling women about their postpartum contraceptive options, clinicians should discuss the possibility of adhesions and proximity to engorged vasculature limiting completion of bilateral total salpingectomy in about 20% of procedures, especially among women with a history of multiple prior Cesarean deliveries.

Acknowledgements

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.contraception.2018.06.003.

References

[1] Dilley SE, Straughn Jr JM, Leath III CA. The evolution and evidence for opportunistic salpingectomy. Obstet Gynecol 2017;130:814–24.

[2] McAlpine JN, Hanley GE, Woo MM, Tone AA, Rozenberg N, Swenerton KD, et al. Opportunistic salpingectomy: uptake, risks, and complications of a regional initiative for ovarian cancer prevention. Am J Obstet Gynecol 2014;210:471. e1–471.e11.

[3] Garcia C, Martin M, Tucker LY, Lyon L, Armstrong MA, McBride-Allen S, et al. Experience with opportunistic salpingectomy in a large, community-based health system in the United States. Obstet Gynecol 2016;128:277–83.

[4] Hanley GE, McAlpine JN, Pearce CL, Miller D. The performance and safety of bilateral salpingectomy for ovarian cancer prevention in the United States. Am J Obstet Gynecol 2017;216:270.e1–9.

[5] Mikhail E, Salemi JL, Mogos MF, Hart S, Salihu HM, Imudia AN. National trends of adnexal surgeries at the time of hysterectomy for benign indication, United States, 1998-2011. Am J Obstet Gynecol 2015;213:713.e1–713.e13.

[6] Powell CB, Alabaster A, Simmons S, Garcia C, Martin M, McBride-Allen S, et al. Salpingectomy for sterilization: change in practice in a large integrated health care system, 2011-2016. Obstet Gynecol 2017;130:961–7.

[7] Chan LM, Westhoff CL. Tubal sterilization trends in the United States. Fertil Steril 2010;94:1–6.

[8] Moniz MH, Chang T, Heisler H, Admon L, Gebremariam A, Dalton VK, et al. Inpatient postpartum long-acting reversible contraception and sterilization in the United States. Obstet Gynecol 2017;129:1078–85.

[9] Castellano T, Zerden M, Marsh L, Boggess K. Risks and benefits of salpingectomy at the time of sterilization. Obstet Gynecol Surv 2017;72:663–8.

[10] Peterson HB, Xia Z, Hughes JM, Wilcox LS, Tylor LR, Trussell J. The risk of pregnancy after tubal sterilization: findings from the U.S Collaborative Review of Sterilization. Am J Obstet Gynecol 1996;174:1161–8.

[11] Jones NL, Schulkin J, Urban RR, Wright JD, Burke WM, Hou JY, et al. Physicians' perspectives and practice patterns opportunistic salpingectomy in high- and low-risk women. Cancer Investig 2017;35:51–61.

[12] Shinar S, Blecher Y, Alpern S, Many A, Ashwal E, Amikam U, et al. Total bilateral salpingectomy versus partial bilateral salpingectomy for permanent sterilization during cesarean delivery. Arch Gynecol Obstet 2017;295:1185–9.

[13] Duncan JR, Schenone MH, Mari G. Technique for bilateral salpingectomy at the time of cesarean delivery: a case series. Contraception 2017;95:509–11.

[14] Ganer Herman H, Gluck O, Keidar R, Kerner R, Kovo M, Levran D, et al. Ovarian reserve following cesarean section with salpingectomy vs tubal ligation: a randomized trial. Am J Obstet Gynecol 2017;217:472.e1–6.

[15] Blumenfeld YJ, El-Sayed YY, Lyell DJ, Nelson LM, Butwick AJ. Risk factors for prolonged postpartum length of stay following cesarean delivery. Am J Perinatol 2015;32:825–32.

[16] Tulandi T, Agdi M, Zarei A, Miner L, Sikirica V. Adhesion development and morbidity after repeat cesarean delivery. Am J Obstet Gynecol 2009;201:56.e1–6.

[17] American College of Obstetricians and Gynecologists. Salpingectomy for ovarian cancer prevention. Committee Opinion No. 620. Obstet Gynecol 2015;125:279–81.

[18] Creinin MD, Zite N. Female tubal sterilization: the time has come to routinely consider removal. Obstet Gynecol 2014;124:596–9.