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Review article

Regret following female sterilization at a young age: a systematic review☆

Kathryn M. Curtis[a,*], Anshu P. Mohllajee[a], Herbert B. Peterson[b,c]

[a]*WHO Collaborating Center in Reproductive Health, Division of Reproductive Health, Centers for Disease Control and Prevention, Atlanta, GA 30341, USA*
[b]*Department of Maternal and Child Health, School of Public Health, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599, USA*
[c]*Department of Obstetrics and Gynecology, School of Medicine, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599, USA*

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Abstract

Women who undergo sterilization may later regret this decision. This systematic review examines whether age at sterilization is associated with poststerilization regret. Using MEDLINE and EMBASE, we identified 19 articles that examined associations between women's age at sterilization and later regret, requests for sterilization reversal and undergoing sterilization reversal or requesting in vitro fertilization (IVF) procedures. Study results showed that the younger women were at the time of sterilization, the more likely they were to report regretting that decision. Women undergoing sterilization at the age 30 years or younger were about twice as likely as those over 30 to express regret. They were also from 3.5 to 18 times as likely to request information about reversing the procedure and about 8 times as likely to actually undergo reversal or an evaluation for IVF. Results of studies that examined risk by continuous age showed a consistent inverse relationship between women's age at sterilization and their likelihood of regretting having had the procedure.

Keywords: Female sterilization; Age; Regret; Systematic review

1. Introduction

Female sterilization is the most widely used method of contraception around the world, with over 200 million married women of reproductive age having been sterilized as of 2003 [1]. In the United States, more than 10 million women have undergone tubal sterilization, and in 2002, 27% of women aged 15 to 44 who were using contraception had undergone tubal sterilization [2]. Although female sterilization is a safe and highly effective method of contraception, it is intended to be permanent, and surgical procedures to reverse sterilization, as well as alternatives such as in vitro fertilization (IVF), are expensive and often unsuccessful. Although most women who undergo sterilization remain satisfied with their choice of a permanent method of contraception, some later regret that decision. In particular, young age at the time of sterilization has been associated with later regret. If factors that lead to regret could be identified prior to sterilization, some of this regret may be prevented.

We conducted this systematic review in preparation for an Expert Working Group of international family planning experts convened by the World Health Organization (WHO) in October 2003 to develop and revise medical eligibility criteria for contraceptive use. In this report, we describe the evidence obtained through our systematic review regarding whether age at the time of female sterilization is associated with later regret, as well as provide the WHO recommendations that were derived in part from this evidence.

2. Materials and methods

We searched the MEDLINE and EMBASE databases for all articles published in any language from 1966 through May 2005 using the following search terms: sterilization, sexual/ and female/; sterilization, tubal.mp.; regret.mp.; reversal.mp.contraceptives. We also searched reference lists of identified articles and relevant review articles for additional citations of interest. We did not consider abstracts of conference presentations, dissertations, or unpublished studies, nor did we contact the authors of individual articles.

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* Corresponding author. Tel.: +1 770 488 6397; fax: +1 770 488 6391.
E-mail address: kmc6@cdc.gov (K.M. Curtis).

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2.1. Study election

Our initial search strategy identified 273 articles, from which we selected primary research articles describing observational studies that reported, by age at sterilization, the proportion of women who experienced poststerilization regret, requested information about sterilization reversal, or underwent sterilization reversal or requested vitro fertilization (IVF) procedures after sterilization. We identified 19 articles that met these inclusion criteria: 10 that examined poststerilization regret, 5 that examined requests for information about sterilization reversal, and 5 that examined use of sterilization reversal or requests for IVF procedures after sterilization.

2.2. Study quality assessment and data synthesis

We summarized and systematically assessed the evidence using standard abstract forms [3] and assessed the quality of each individual piece of evidence using a preliminary draft of a new grading system developed by members of the Grades of Recommendation, Assessment, Development and Evaluation (GRADE) Working Group (Appendix A) [4]. Study characteristics and quality assessments are described in Table 1. Because of the heterogeneity of the studies described, we did not calculate summary measures of effect.

3. Results

3.1. Regret

Ten articles reported on eight studies examining women's poststerilization regret [5–14]. Of these, four studies reported either mean age at sterilization or proportions by age groups at sterilization for women who experienced regret and for those who did not [5–8]. The results of these studies showed that women who were younger at the time of sterilization were more likely to experience regret and that the mean age of those experiencing regret was less than that of those not experiencing regret, in some cases significantly so. The other four studies estimated women's relative risk of regretting their decision to be sterilized by their age at sterilization [9–14]. Results of a study of women who had undergone sterilization in Puerto Rico showed a 10% increase in risk of regret [odds ratio (OR), 1.10; 95% confidence interval (CI), 1.04–1.17] for every 1 year decrease in age [9]. A study using data from the 1991 Dominican Republic Demographic and Health Survey showed that, compared with women aged 30 years or older at the time of sterilization, those less than age 30 were 2.17 times ($p<.01$) as likely to report being dissatisfied with their decision to become sterilized, 1.39 times (not significant) as likely to report regretting their decision and 2.43 ($p<.01$) times as likely to report both dissatisfaction and regret, and also to report that they would not make the same decision again [10]. Results of the United States Collaborative Review of Sterilization (CREST), which followed 11232 women with tubal sterilization for up to 14 years, showed that the 14-year cumulative probability of regret was 20.3% among women aged 30 or younger at the time of sterilization but only 5.9% among women older than 30 [13]. They also showed that women 30 or younger at the time of sterilization were 1.9 times (95% CI, 1.6–2.3) as likely to report poststerilization regret as those older than 30 after adjustments for other factors. Another analysis from the CREST data compared regret among the tubal sterilization group with that among women whose husbands had undergone vasectomy [14]. After 5 years of follow-up, women aged 30 years or younger at the time of tubal sterilization were 2.2 times (95% CI, 1.6–3.1) as likely to regret their decision than were those over age 30, but women who were 30 years or younger at the time of their husbands' vasectomy were only 1.4 times (95% CI, 0.6–3.0) as likely to regret the decision as were those over age 30.

3.2. Request for reversal

Five studies examined women's requests for reversal of tubal sterilization, by their age at the time of sterilization [15–19]. Two studies reported that the mean age at sterilization of women who requested reversal (25 and 26 years) was less than that of women who were satisfied with their sterilization decision (31 years for both) [15,16]. Another reported that 14% of women less than age 30 at sterilization wanted a reversal, compared with 6% among those 30 or older at sterilization ($p<.05$) [17]. In a case-control study in Brazil, researchers compared 216 women who requested sterilization reversal with 216 sterilized women who had never requested reversal and who were being seen for other reasons at the same hospital [18]. Results of their unadjusted analysis showed that women who were younger than 25 at the time of sterilization were 18 times (95% CI, 5.95–91.51) as likely to request a reversal, and that women aged 25 to 29 were 5 times (95% CI, 2.5–13.25) as likely to do so, compared with women aged 30 or older at the time of sterilization. Multivariable analysis revealed that the risk of a woman requesting reversal decreased by 31% (OR, 0.79; 95% CI, 0.73–0.85) for each increasing year of age at surgery. Results of another analysis from the CREST data showed that the cumulative 14-year probability of requesting information about reversal was 40.4% among women aged 18–24 at the time of their sterilization, 15.6% among those aged 25–30, 8.2% among those aged 31–35 and 4.4% among those over age 35 [19]; they also showed that women aged 18–24 at the time of sterilization were 3.5 times (95% CI, 2.8–4.4) as likely to request information about reversal than those older than 30.

Table 1
Studies evaluating age at time of female sterilization as a risk factor for poststerilization regret

Author, year	Study design	Study population	Time since sterilization	Outcome	Results	Quality
Regret						
Allyn et al., 1986 [5]	Survey	487 women with sterilization, US	Mean, 70 months	Regret	Negative correlation between age at surgery and regret (Pearson correlation coefficient = −0.22; p < .001)	Low
Thranov et al., 1988 [6]	Survey	547 women with sterilization, Denmark	Mean, 50 months	Regret	Proportion with regret by age <30, 10% ≥30, 4.5% (p = .05)	Low
Boring et al., 1988 [9]	Survey	846 women with tubal sterilization, Puerto Rico	0–28 years	Regret	OR, 1.10 (95% CI, 1.04–1.17), for every 1 year decrease in age, ages 17–44 years	Low
Marcil-Gratton, 1988 [7]	Survey	495 women with tubal sterilization, Canada	–	Regret	Proportion with regret by age 20–29, 35.9% 30–34, 20.3% 35+, 17.9% (p ≤ .05)	Low
Platz-Christensen et al., 1992 [8]	Cohort	2253 sterilized women, Sweden	5–11 years after sterilization	Regret	Proportion with regret by age (p for difference from no regret) 25–29, 14.5% (p < .001) 30–34, 7.4% (p < .05) 35–39, 3.8% (ns) 40–44, 1.7% (ns) 45+, 1.4% (small n)	Low
Loaiza, 1995 [10]	Survey	Dominican Republic Demographic and Health Survey, 1991	–	Dissatisfaction Regret "True" regret (consistent regret answers to several questions)	OR for ages <30 vs. ≥30 (ref) Dissatisfaction 2.17 (p < .01) Regret 1.39 "True" regret 2.43 (p < .01)	Low
Hillis et al., 1999 [13], Wilcox et al., 1991 [12], Grubb et al., 1985 [11]	Cohort	11,232 women with tubal sterilization, US	Up to 14 years (mean 6.5 years)	Regret	>30 years, 1.0 18–30 years, 1.9 (95% CI, 1.6–2.3)	Intermediate
Jamieson et al., 2002 [14]	Cohort	525 women whose husband's had undergone vasectomy and 3672 women with tubal sterilization, US	5 years	Women's regret for either tubal sterilization or husband's vasectomy	18–30 years vs. >30 years (referent) Tubal sterilization RR, 2.2 (95% CI, 1.6–3.1) Vasectomy RR, 1.4 (95% CI, 0.6–3.0)	Intermediate
Request for reversal						
Leader et al., 1983 [15]	Case control	159 women requesting sterilization reversal/ 160 women satisfied with sterilization	2–6 years	Request for reversal	Mean age at sterilization Reversal group 25.0 (±4.0) Satisfied group 31.2 (±4.5) p < .005	Low
Abraham et al., 1986 [16]	Case control	32 women seeking reversal of sterilization/ 53 sterilized women not seeking reversal, Australia	Mean, 4.9 years	Request for reversal	Mean age at sterilization Reversal group, 26 Satisfied group, 31	Low
Henshaw and Singh, 1986 [17]	Survey	8583 couples protected by either female sterilization or vasectomy	–	Want reversal	Percentage wanting reversal by age at sterilization <30, 14% ≥30, 6% (p ≤ .05)	Low

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Table 1 (*continued*)

Author, year	Study design	Study population	Time since sterilization	Outcome	Results	Quality
Hardy et al., 1996 [18]	Case control	216 women requesting reversal/216 sterilized hospital controls, Brazil	1–22 years	Request for reversal	Crude OR (95% CI) >29 1.0 25–29, 5.37 (2.50–13.25) <25, 18.33 (5.95–91.51) Adjusted OR (95% CI), 0.79 (0.73–0.85) for each increasing year of age at surgery	Intermediate
Schmidt et al., 2000 [19]	Cohort	11,232 women with tubal sterilization, US	8–14 years	Request for reversal information	Request for reversal information—RR (95% CI) by age 18–24, 3.5 (2.8–4.4) 25–30, 2.2 (1.8–2.7) >30, 1.0	Intermediate
Obtaining reversal or requesting IVF						
Clarkson and Gillett, 1985 [20]	Case control	Women seeking reversal/ women with sterilization who had not sought reversal (numbers not reported), New Zealand	–	Reversal	Mean (SD) age at sterilization Reversal group, 27.4 (3.8) Nonreversal group, 32.0 (5.6) p<.001	Very low
Ramsay and Russell, 1991 [21]	Case control	55 women with reversal of sterilization/ 55 sterilized women not requesting reversal	–	Reversal	Mean age (assumed standard deviation) at sterilization Reversal group, 26.2 (3.6) Satisfied group, 32.5 (5.2) p<.001	Low
Schmidt et al., 2000 [19]	Cohort	11,232 women with tubal sterilization, US	14 years	Reversal	Obtaining reversal 18–30, 7.6 (3.2–18.3) >30 1.0	Intermediate
Kariminia et al., 2002 [22]	Case control	97 sterilized women requesting IVF/101 sterilized women with no regret, Australia	Mean time between sterilization and IVF— 6.8 years	Regret leading to IVF	Age, OR (95% CI) <25, 8.65 (2.71–27.60) 25–29, 4.23 (2.01–11.64) 30–34, 1.0 35–39, 0.41 (0.15–1.12)	Intermediate
Trussell et al., 2003 [23]	Cohort	321,929 female sterilizations and 310,827 male sterilizations, Canada	1980–1999	Reversal of female sterilization or vasectomy	The cumulative probabilities of reversal are highest in the youngest age groups (ages 15–30 years) for both men and women.	Low

Grading for body of evidence: intermediate.

3.3. Sterilization reversal and request for IVF procedures

Three case-control [20–22] and two cohort [19,23] studies examined the risks of undergoing sterilization reversal or evaluation for IVF procedures to achieve pregnancy. Two studies found significantly younger mean ages at sterilization among women undergoing reversals (27 and 26 years) compared with sterilized women who did not undergo reversal and were presumed to be satisfied with sterilization (32 and 32.5 years, respectively) [20,21]. Results of an analysis of CREST study data showed that the 14-year cumulative probability of obtaining reversal was 2.1% (95% CI, 0.9–3.4) among women aged 30 years or less at the time of sterilization and 0.2% (95% CI, 0.0–0.3) among women older than 30. Even after adjustment for other risk factors, women aged 30 or less at the time of their sterilization were 7.6 times (95% CI, 3.2–18.3) as likely to undergo reversal than were women older than 30 [19]. An Australian case-control study of 97 sterilized women who underwent evaluation for IVF procedures (many of whom had already undergone reversal) and 101 women who were satisfied with their sterilization [22] showed that, compared with women aged 30–34 at the time of their sterilization, those aged 25 or less were almost nine times as likely to request IVF (OR, 8.65; 95% CI, 2.71–27.60), and those aged 25–29 were four times as likely to do so (OR, 4.23; 95% CI, 2.01–11.64). Finally, a cohort study of 321,929 women and 310,827 men who underwent sterilization in Canada showed that the cumulative probability over 20 years of obtaining sterilization reversal was highest

among women aged 15–30 at the time of sterilization and among men aged 18–32 at the time of vasectomy—approximately 4% for both men and women compared with 0.2% for women older than age 35 and 1.0% for men older than age 36 [23].

4. Discussion

Overall, evidence suggests that the younger the women are when they undergo sterilization, the more likely they are to regret the decision, to request information about sterilization reversal, or to obtain a reversal or undergo evaluation for IVF procedures. Although the studies we examined consistently showed a negative correlation between women's age at the time their sterilization and their risk of regretting their decision, none of them identified an age threshold at which the risk of regret stabilizes. Results of the three most recent studies that we reviewed [14,22,23] were consistent with those of earlier studies, but each also provided some new information. The new analysis of CREST study data confirmed that women who had undergone sterilization at 30 years of age or younger were more likely to regret their decision than were older women, but this association was not apparent among women whose husbands had undergone a vasectomy [14]. The case-control study from Australia was the first to report on a large group of sterilized women undergoing evaluation for IVF procedures—almost all had undergone evaluation for sterilization reversal, and 61% had actually had their sterilization reversed but were not successful in achieving pregnancy [22]. The third recent study, which examined reversals of both female sterilization and vasectomy procedures in Canada, showed that the 20-year rate of reversal among both men and women was higher among those aged 15–30 at the same time of sterilization than among those over 30, around 4% over 20 years for both men and women [23]. These figures are somewhat higher than the 2.1% 14-year cumulative probability of reversal among women in the same age range found in an analysis of CREST study data [19].

Overall, this body of evidence was given an "intermediate" quality rating overall. These studies were generally well-conducted, observed strong and consistent associations, and adjusted for possible confounders. Potential biases that may have affected the results of these studies include differential loss to follow-up and failure to control for additional confounders that may have affected the association between age and regret, such as marital disharmony, knowledge of other long-term methods of contraception and quality of presterilization counseling. An additional issue in interpreting these results is determining what the various outcome measures actually indicate, because "regret" after sterilization is an attitudinal measure for which there is no standard definition [13]. Each study asked different questions and defined regret in various ways. Some of the studies directly asked women whether they regretted their decision to undergo sterilization, whereas other studies used less direct approaches or a series of questions. Although it is tempting to assume that women who request information about sterilization reversal or who obtain a reversal or undergo IVF procedures after sterilization are expressing stronger or more persistent post-sterilization regret than those who do not, this may not always be the case. For example, women's decisions to undergo or not undergo these procedures may be more reflective of their financial resources than of the strength of their regret.

Although young age at time of sterilization is a risk factor for poststerilization regret, it is important to note that the majority of women in all age groups do not regret their decision to undergo sterilization and that other women may regret their decision not to undergo sterilization, perhaps because of an unwanted pregnancy or the side effects of temporary contraceptive methods [13].

In 2003, the WHO reviewed this evidence during a meeting of the Expert Working Group for medical eligibility criteria for contraceptive use [24]. The Expert Working Group recommended that the condition of "young age" should be given a rating of "caution" for female sterilization, meaning that the procedure is normally conducted in a routine setting, but with extra preparation and precautions. Specifically, the recommendations state that "Young women, like all women, should be counseled about the permanency of sterilization and the availability of alternative, long-term, highly effective methods" [24].

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Appendix A. Study quality assessment

Individual study: Each study was given a rating of very low, low, intermediate or high based on the interval validity of the study. If the study was indirect, the quality of the individual study was lowered by one level. If the study was direct, the quality of evidence was kept the same. Similarly, if there was sparseness of the data, the quality of the individual study was lowered by one level.

Body of evidence: The quality of the body of evidence was the highest rating given to an individual study. If the results were inconsistent, the quality of the body of the evidence was lowered by one level. If results were consistent, then the quality of the body of the evidence was left at the original level. Similarly, if there was reporting bias (publication bias), then the quality of the body of evidence would be lowered by one level.

Quality of evidence across studies for each main outcome

RCT	Quality of the evidence	Observational studies
No serious flaws in study quality	High	Extremely strong association and no threats to validity
Serious flaws in design or execution or quasi-experimental design	Intermediate	Strong, consistent association and no plausible confounders
Very serious flaws in design or execution	Low	No serious flaws in study quality
Very serious flaws and at least one other serious threat to validity	Very low	Serious flaws in design and execution

Additional factors that lower study quality are important inconsistency of results, some uncertainty about directness, high probability of reporting bias and sparseness of data. Major uncertainty about directness can lower the quality by two levels

Additional factors that may increase quality of observational studies are all plausible residual confounding, if present, would reduce the observed effect, and evidence of a dose–response gradient.

Adapted from: Judging Confidence: Guidelines for Grading Evidence and Recommendations. Grades of Recommendation, Assessment, Development and Evaluation (GRADE) Working Group. Draft, January 2003.

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